Fourth International Dental Congress.

VOL. II.

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SECTION III:

Chemistry and Metallurgy.

Chairman—Dr. J. D. HODGEN, San Francisco, Cal.
Secretary—Dr. J. P. BUCKLEY, Chicago, Ill.

FIRST DAY—Tuesday, August 30th.

THE section was called to order at 2.30 P.M. by the chairman, Dr. Joseph D. Hodgen, San Francisco, Cal.

The CHAIRMAN. It is very gratifying to me to meet those present. I am greatly pleased to have so much interest shown in the Section on Chemistry and Metallurgy. Dr. Buckley and I have worked hard to make the meeting of this section a success, and though the program is short I feel confident it will be worthy of your attention. I have prepared a paper on the relation of chemistry to dentistry, and while this may be presented more particularly from the standpoint of a teacher of chemistry than from that of the practitioner of dentistry, yet I trust that every scientific practitioner will find something of interest in it.

Dr. HODGEN then read a paper on "Chemistry and Dentistry," as follows:

Chemistry and Dentistry.

By JOSEPH D. HODGEN, D.D.S., San Francisco, Cal.

GENTLEMEN, it seems fitting at this time, the opening of the Section on Chemistry, to briefly discuss the relationship of this science to the more composite science and art of dentistry, in which we cannot fail to observe chemistry playing a very important part.

The study of modern chemistry presents many phases, but in its simplest classification it is *pure* or theoretical, and *applied* or practical. Theoretical chemistry has to do with the laws governing chemical changes, while applied chemistry treats of the application and eco-

nomic relation of chemistry to the arts and industries. Accordingly we find among its many applications medical, metallurgical, pharmaceutical chemistry, etc.

In medical education of today and in the advancement of medicine as a science and art its technical chemistry has kept abreast with, if not in advance of, the numerous other subjects which go to make up a complete medical training. In metallurgy and in pharmacy, chemistry is the most important science, and in these its application has most marvelously advanced their respective fields of service to art and to mankind.

In a general way the application of chemistry to medicine and to pharmacy varies greatly. It might be said they are diametrically opposed: medical chemistry is essentially analytic, pharmaceutical chemistry is largely synthetic. In the one the physician depends greatly upon his analytic examinations of excretions, secretions, and tissues for his diagnosis. In the other the pharmacist has developed his stock of remedial agents, etc., by building up new and imitating natural products.

The instructors of chemistry in dental schools have, almost invariably, been drawn from the ranks of pure science, from medicine, or from pharmacy, instead of from our own profession. The result of this is most unfortunate: unfortunate in that such a procedure is a mere makeshift, and that it tends to retard, if not entirely prevent, harmonious methods in the teaching and systematic application of the science. Teachers taken from other professions, no matter how closely those professions may be allied to dentistry, cannot have more than a secondary interest in the work required of them. They are, therefore, generally induced to undertake the instruction of dental classes solely for pecuniary returns, and very naturally give in return for their salaries a mere perfunctory service dictated by a faculty which oftentimes has no conception of the requirements, benefits, or methods of instruction in chemistry, the teacher having been selected solely upon a reputed general knowledge of the science. Such lack of interest in the good of the dental profession or its advancement, on the part of those chosen as instructors of dental classes, is an unquestionable misfortune They are never, or are rarely ever, in attendance at dental meetings, and consequently conferences so essential to harmonious methods of teaching or systematic advancement of the application of this science to dentistry are practically unknown. The absence from our associations of such as are qualified—for the fact is that few dentists are sufficientlyfamiliar with the science of chemistry to scientifically discuss dental subjects from a purely chemical standpoint—is not appreciable to many because the benefits of such discussion are unknown. Moreover, in that such instructors are to be had and are pretty generally employed, there is little or no incentive for the dentist who might desire to fit himself as a teacher of chemistry, to do so under such uninviting circumstances. The real and consequent misfortune of such instruction, or lack of instruction, lies in the fact that the opportunity for a proper application of this science to dentistry has been so greatly delayed that at this advanced time dentistry has no real application of the science of chemistry sufficiently technical to be termed "dental chemistry."

I trust the statements I have made relative to instructors in chemistry to

dental classes will not be misconstrued. It is not my desire to disparage the efforts of those engaged in such instruction, for although dentistry has egregiously erred in not developing its own chemistry, these men have performed yeoman service for the profession which it would not do for itself, and in all probability dentistry would have been in a sad state had it not been for their services.

Nor do I wish to disparage the noble efforts of those very few who have sought to give to the profession a text-book on dental chemistry. Theirs have been steps in the right direction and they have done their work as well as possible.

If the profession must have instruction in chemistry from one of these outside sources it is probably better that it be secured from the pure scientist. Then, if the inclination or talent for original work be inherent in the student, he will receive a foundation upon which he may build without the handicap of having been taught a science as applied to an art other than that for which he is preparing himself. If practical medical chemistry or pharmaceutical chemistry are, as basal studies, antipodal, which I believe they are, however auxiliary they may practically become, then it is only logical to conclude that one, the other, or either is not suited to dental education.

It is not expected nor is it necessary, that every student graduated from a dental school shall be a practical chemist. The requirements of the dental practitioner do not demand it. But it is expected that the dental graduate is sufficiently informed in theoretical chemistry to be able to see the application of this science to his profession; to read intelligently explanations of phenomena encountered in routine practice, and to appreciate the properties possessed by the various materials he is called upon to use in that practice. Such an understanding of the science of chemistry, I believe, can very rarely be had from teaching in medical or pharmaceutical chemistry, especially since the present entrance requirements to dental schools fail to make a knowledge of theoretical or pure chemistry an essential. To teach a dental student who is unacquainted with the pure science the application of that science to medicine or pharmacy—and it is done many times in mixed classes—is time lost, worse than lost. The unfortunate student is not only unable to comprehend that which is being taught, but moreover, as has already been hinted, being taught another application of the science he loses sight of any dental application he might otherwise deduce from the pure science.

I repeat, and with profound regret, dentistry today has no technical chemistry. If it had, text-books on medical and pharmaceutical chemistry would not be used for instruction in nine out of ten colleges of our country. Having no dental chemistry, no chemistry as such can be taught. But a dental chemistry can be developed if the colleges will accept teachers of this science from the ranks of our own profession. There are many dentists who are acquainted with pure chemistry, and of these some may be found who, having the talent and the application, may make most competent teachers and who will apply the science practically wherever and whenever it can at present be applied. The eventual result will be a *dental chemistry*. Such an application, however, cannot be the product of one mind, nor indeed of one generation, but is to be had only through ra-

tional development here, as has been the case in all arts and industries. If such a course was followed by our schools logically, a greater interest in the science and its dental application would be manifested by the students of dentistry, and the benefits of chemistry would be greatly increased. As an art, the progress made by dentistry in the span of a single human lifetime has been the marvel of an appreciative laity, but its continued progress now demands the helpful assistance which scientifically applied chemistry alone can give it.

The dentist of today needs to have a fair knowledge of the facts and the phenomena presented by the science of chemistry, and he needs this knowledge applied to dentistry. The dental teachers of our day need to much more fully and more generally understand that chemistry is one of the most important fundamental sciences upon which the art of dentistry is builded.

That the dentists of the future may be acquainted with these facts and phenomena of chemistry, the students of today must be furnished with a good text-book on inorganic, organic, and physiological chemistry, for diligent study, and a competent instructor to explain and elaborate it. But above all there must be provided a thorough laboratory course to demonstrate and fix in the mind the facts learned.

Merely memorizing facts, however, is of small value. Indeed, overloading the memory with facts, like overloading the stomach, may defeat mental digestion. It is not the knowing a great many things, but the knowing how to use to the best advantage what one knows, that most avails. We should learn to marshal our knowledge to good purpose—should learn rather to reason than to merely think. Doing must accompany thinking or there will be no power of execution. Mental vigor of any kind is gained, not by memorizing or through professors, but by mental self-help, which utilizes the knowledge as it is acquired. We grow in power by investigation, deep concentration, thinking, planning, and bringing about results without the assistance of others. One self-wrought problem will give more vigor than a thousand worked out for us. Someone has said, "It is the constant stretching of the mind over large problems, over models—it is independent thought that increases mental power."

Too much so-called chemistry is taught today which practically consists of tabulated facts respecting the various substances known. No science can be intelligible when the facts and phenomena are separated from the theories which systematize and arrange them. Indeed, science is but the orderly arrangement of facts in a rational system. Obviously, then, it is eminently essential in the study of a science to distinguish facts from theories. Facts alone can be regarded as absolute knowledge. They are actual and immutable. They are the imperishable stones of which the structure of science is builded, and are the gift of God to man. Theories at best are only man's explanations of facts. Imperfect, then, as they must be, they are liable to constant change, and subject to limitations in development. They are, however, the means of binding the stones together, giving symmetrical form and systematic arrangement to the structure. The form of the edifice may be changed or altered, torn down or destroyed, but the stones remain, and from them a new and more perfect structure may be erected.

The theory of a science cannot properly be separated from the history of that science. A retrospect of the past, especially in exact sciences, alone affords a proper comprehension of what is accepted today. It is only when we are acquainted with the theories which preceded those accepted at present that the latter can be fully understood, because there is almost always an intimate connection between them. But, apart from this real advantage of the study of history, which thus in my opinion leads to a clearer understanding of the present position, another advantage yet may be adduced which is perhaps of still greater value to the student, namely, the accurate estimation of the value of theories. Further, by the study of history our faith in authority is diminished, which faith produces pernicious effects by obstructing the way for original development of the individual. On the other hand we also learn, it is true, that theories are necessary for further development, and that, although the actual teachings of science may lie in the facts, their real intellectual significance can only be acquired by connecting isolated observations by means of hypothesis, so that the present position consists far more in the mode of explaining observations than in the observations themselves.

I dwell thus upon the value of the theory of chemistry for two reasons: First, because it is so essential to the comprehension of the real science and its proper application; second, because I have observed it so greatly neglected, not only in the dental curriculum, but also in preparatory schools.

Dentists as teachers of chemistry in dental schools cannot all hope to be original investigators as well, for in most instances the time taken from practice for the purpose of study and teaching precludes the allotment of additional time for investigation, even if the ability and inclination served. But the practitioner having a bent for investigation, and a technical dental chemical education, will be the real Moses to lead the profession out of the darkness in which it has long been groping, as far as investigations along chemical lines are concerned.

The profession is clamoring today for help in plastic filling materials, especially in cements, in porcelains, etc., and that at the hands of simple inorganic chemistry, though this may not be realized by all. It is demanding more knowledge for progress in antiseptics, disinfectants, germicides, obtundents, anesthetics, and remedial agents. Its knowledge of these is merely empirical and unscientific. It is absolutely benighted in physiological and pathological knowledge of dental tissue and oral secretions, upon which dental chemistry could shed the light of noonday. It is, or will be, without dental chemistry, at a standstill in its advancement in dental bacteriology, histology, technics, physiology, pathology, metallurgy, etc., compared with what it would be with an up-to-date dental chemical education.

Dentistry has never accepted from chemistry anything like the assistance that science can give. Chemistry in dentistry has never been given the attention it deserves. Dentists, as a rule, have less knowledge of chemistry than of any other subject allied to dentistry. There is an astonishing lack of dental chemical literature. We will, however, hope for something better in the future; we will hope for a real application of chemistry to dentistry, sufficiently technical to be known as *dental chemistry*.

Discussion.

Dr. J. P. Buckley, Chicago, Ill. There is no doubt that the essayist is right when he refers to the unfortunate condition that exists in our dental colleges—*i.e.* that the men selected to teach chemistry to our dental students in most instances are not dentists. I have said before, and often, that if there be any one subject that should be taught to the students in our dental colleges, it is the subject of chemistry; because no one without a knowledge of chemistry is able to apply that science to the practice of dentistry. It is absolutely impossible for the medical man, or the pure scientist having no knowledge of the practice of dentistry, to make this subject interesting and pleasant to the dental student, whereas on the other hand it can be done even though the dentist's knowledge of chemistry be less than that of the medical man or the pure scientist.

It is to be regretted that we have no text-books on the subject of dental chemistry. This is also true in regard to other subjects; we need text-books on other dental subjects, such as materia medica, etc.

Dr. Alfred Owre, Minneapolis, Minn. Dr. Hodgen and I have always agreed on these high ideals, and how the subject of chemistry ought to be taught in dental colleges; consequently I have no points at issue with him, and am very much in the same plight as Dr. Buckley; as long as we all agree we can do nothing but commend the paper. We all recognize the importance of the subject. The pure scientist can admirably teach the science of chemistry; he cannot, as a rule, apply it to the subject of dentistry. It is the hardest kind of work for me to get even some slight advice from my chemistry teachers as to its special application to some question of practice in dentistry. The only way I can arrive at a conclusion in regard to some problem involving the application of chemistry to dentistry is to work it out myself; I get very little assistance from the scientist who is teaching chemistry.

Dr. A. W. Harlan, New York, N. Y. One of the strong arguments in favor of a four-year course in dental colleges would be the absolute and thorough instruction of the dental student in the science of chemistry; I do not mean in dental chemistry, I mean in chemistry as a science itself. If a man be thoroughly grounded in chemistry it does not matter so much whether he gets it from lectures or from demonstrations, but he must do a certain amount of laboratory work in order to familiarize himself with the basal principles of that science. I entered upon the study of dentistry an absolute ignoramus, so to speak, and the few lectures I listened to on chemistry and the few demonstrations I saw in chemistry did not fit me at all to comprehend this subject, because the colleges themselves did not give a sufficiently prolonged course. I realize the deficiency in my professional education in that particular. I think that if a student could listen to one or two didactic lectures per week, and work six or eight or ten hours per week in the laboratory, when he did get into the second or third year he would begin to understand some of the things that the lecturers were talking about and which he could not understand if he did not have that practical experience. So I wish to commend the paper, in particular, on account of its advocacy of a strict and prolonged period of study in chemistry, which is one of the three basal subjects that we have in dentistry.

The CHAIRMAN. We are honored particularly by the presence of Dr. Cassidy of Covington, Ky., who has done yeoman service in the teaching of chemistry. We shall be glad to hear from Dr. Cassidy.

Dr. J. S. CASSIDY, Covington, Ky. Like the previous speakers, I am very pleased with the paper; and I must offer just a little idea in connection with it. We may have a knowledge of chemistry, a great deal of knowledge; we may have a thorough knowledge of its fundamental principles and their application—of pure science as well as of applied science; but we may make mistakes in the therapeutic application of that knowledge. We know very well that the application of an alkali will destroy an acid, and we have gone on for years in the use of alkaline treatment for diseases of the mouth; but there are other conditions and effects of the treatment that must be taken into account besides merely the acid condition of the mouth. If we have uric acid in the body we neutralize that by giving an alkali; but physiological chemists tell us the more alkali, the greater the tendency of the system to develop more uric acid. In the mouth, acid is developed by fermentation; we know that an alkali will destroy that acid; that is a chemical fact—it cannot be disputed. But when we apply that alkali, one of the conditions favorable to the development of the acid in the mouth is established; we thus encourage the growth of acid-forming bacteria. That kind of bacteria do not thrive very well unless they have either a neutral or an alkaline medium. One of the factors causing dental caries is bacteria; they precede the formation of acid, and when we use an alkali it is with the result of preserving the lives of those very creatures necessary to form the acid. Is that good treatment? I should think not, and yet it is a question that has never been raised before that I know of. It has been taken for granted that because acids destroy the teeth we must use alkalies as a preservative of the teeth.

Now we have developed certain ideas in chemistry some way or other which seem to me are not just up with the times. We say that certain chemicals have an affinity for each other; that caustic soda and palmitic acid have an affinity for one another. We call them likes or dislikes, but still the idea connected with these terms might be considered a little more closely. Elements or compounds that are opposed to each other try to destroy each other; they have about as much affinity for each other as two prize fighters have in the ring; they want to get together but not through love. Text-books are all right, but the lecturer is better than a text-book; he ought to be a text-book unto himself; and the doctor is perfectly correct in saying that the majority of teachers in our dental schools, not being dentists do not pay any attention to subjects of interest to dentists in the teaching of chemistry. I know of one text-book in particular which was written by a teacher in a dental college in the East, and as to a matter like this represented on the blackboard, sodium dioxid, no allusion is made to it at all; and if there be an allusion in the later editions, there is no application made as to its use in our practice. There is no allusion whatever to dental practice in the entire book, although the author is a teacher in a dental college as well as in a medical college. Teachers of chemistry in dental colleges are not dentists; they are purely chemists; and when a text-book is produced by a mere dentist there is no consideration at all

given to it by the teacher of mere chemistry—none at all—consequently the text-book is a failure financially; and who is going to bear the expense of getting up such a text-book as our dental colleges would like to have, I do not know, unless the colleges themselves would get together and publish one at their joint expense.

The CHAIRMAN. Dr. Buckley has prepared a paper which, in my estimation, is an excellent one, and I would ask for it particular attention: "The Chemistry of Pulp-Decomposition."

Dr. J. P. BUCKLEY, Chicago, Ill. It seems as though the chairman and the secretary of this section are furnishing all the statements to be commended or refuted; but this happens because we have so few papers on the program.

The Chairman then called on Dr. J. P. BUCKLEY, Chicago, Ill., who read the paper which here follows:

The Chemistry of Pulp-Decomposition; with a Rational Treatment for This Condition and Its Sequelae.

By J. P. BUCKLEY, D.D.S., Chicago, Ill.

THE subject of pulp-decomposition is one that has commanded the attention of many investigators in our profession, and at the present time the conclusions as to the chemistry of the process are many and varied. Until we comprehend more fully the nature of the chemical reactions taking place in the splitting up of the complex bodies of dead pulp tissue and have a more definite knowledge of the end products thus produced, the application of drugs and remedies for the correction of the putrescent condition and the restoration of the color of the tooth-structure can never be placed on a rational basis, but must be empirical, as it has been in the past. This is not in accordance with the tendency of this age, either in medicine or dentistry.

As pulp-decomposition and its sequelæ is a subject in which every practicing dentist is vitally interested, it should be our endeavor to establish a rational treatment for this condition. In order to accomplish this, it is necessary that we study the chemistry of this process and thereby gain an intimate knowledge of the end products resulting therefrom. It has never been shown that the pulp tissue differs in any particular essential, so far as the chemical constituents are concerned, from the other tissues of the body; therefore your attention will be directed briefly to the chemical composition of animal tissue.

There are at the present time about seventy-six elements known to chemistry, but of this number less than seventeen unite, in varying proportions, to form the chemical basis of the animal body. In fact, six elements are about all with which we are concerned in the study of the decomposition of the pulp tissue. These elements are carbon, C; hydrogen, H; oxygen, O; nitrogen, N; sulfur, S; and iron, Fe.

For convenience in study, the various substances found in animal tissue are divided into two general classes, the classification being based upon the pres-

ence or absence of the element nitrogen, and are called nitrogenous and non-nitrogenous substances.

NITROGENOUS SUBSTANCES.

We are taught by physiologists that nitrogenous organic bodies take the chief part in forming the solid tissues, and to an extent are also found in the fluids of the body. Proteid or albuminous substances are the principal nitrogenous compounds, and one or more enter, as an essential part, into the formation of all living tissue. The elements which constitute the proteid molecule are carbon, hydrogen, oxygen, nitrogen, and a small amount of sulfur. Phosphorus has also been known to exist. While some chemists have attempted to construct a formula for the molecule, none has been accepted as correct, the opinions of investigators being so varied. To the casual observer it may seem strange that a molecule consisting largely, as it does, of carbon, hydrogen, oxygen, and nitrogen, should have these four simple elements so arranged as to baffle chemists in their efforts to construct a rational formula. But this is not a difficult thing to understand when we know that of all the elements none differ more widely from each other in their physical and chemical properties than these four.

Carbon is a black, solid substance, which can scarcely be fused or volatilized. Hydrogen, oxygen, and nitrogen are colorless gases, which cannot be solidified by any known means, and can be converted into liquids only with difficulty. The three gases also differ in their chemical activity. Hydrogen is combustible; oxygen will not burn, but will support combustion; while nitrogen is perfectly indifferent. Fortunately, too, for nature, in her effort to arrange these elements into a complex molecule, the valency of each differs. Hydrogen is univalent, oxygen bivalent, nitrogen trivalent, and carbon quadrivalent, generally considered. Carbon atoms have also, to a higher degree than the atoms of any other element, the power of combining with one another by means of a portion of the affinity possessed by each atom, thereby increasing the possibilities of the formation of complex compounds. Thus many atoms of the same element occur in each molecule, which, together with the fact that one of the elements is that peculiar, undecided and indifferent nitrogen, aids materially in explaining the reason for the instability of the proteid molecule, or the ease under certain conditions with which it is decomposed.

NON-NITROGENOUS SUBSTANCES.

The non-nitrogenous substances consist of carbohydrates and fats. Several classes of carbohydrates are known to exist, all of which are much less complex than the proteid group; and the arrangement of the atoms in the molecule is much better understood. The carbohydrate molecule is composed of three elements—carbon, hydrogen, and oxygen. There are always six (or a multiple of six) atoms of carbon in the molecule, while the hydrogen and oxygen exist in the proportion to form water. These compounds readily undergo the process of fermentation.

Human fats are principally mixtures of palmitin, $C_3H_5(C_{16}H_{31}O)_3O_3$, stearin, $C_3H_5(C_{18}H_{35}O)_3O_3$, and a small amount of olein, $C_3H_5(C_{18}H_{33}O)_3O_3$. As shown by the formula of these compounds, the molecule of each consists of

carbon, hydrogen, and oxygen. The proportion of these elements varies in the different compounds. That fats are decomposed or saponified by alkalies, or ferments in an alkaline medium, should be remembered both in the treatment and the bleaching of teeth.

Thus we have every reason for believing that the pulp tissue, like nearly all living organic tissue, is composed of proteids, carbohydrates, and fats. On this hypothesis, then, we will endeavor to ascertain the final products resulting from the decomposition of this tissue.

FERMENTATION AND PUTREFACTION.

Before doing so, however, it may be well that we have a clear understanding of what is meant by the terms fermentation and putrefaction. These terms are applied to peculiar kinds of decomposition by which the molecules of certain organic substances are broken up into simpler compounds. The difference between the terms is that fermentation is applied to the decomposition of those substances which belong to the group of carbohydrates, while putrefaction is applied to the decomposition of those substances which properly belong to the proteid group, and are classified as nitrogenous substances.

PULP-DECOMPOSITION.

The decomposition of the pulp tissue is essentially an analytical process, which takes place gradually. Through the agency of micro-organisms these complex bodies are broken up into simpler and well-known compounds. That is to say, the micro-organisms first act upon these complex and unstable substances, splitting them up into less complex compounds—which, however, are capable of further analysis, and the process goes on, conditions being favorable, until the decomposition is complete.

The desire to acquaint myself with the nature of the reactions taking place in this process has led me to do much investigating along this line during the last few years; and I state here, without any hesitancy, that the chemical reactions taking place in the pulp-chamber and root-canals of teeth containing pulps undergoing the process of decomposition cannot be duplicated in test tubes in the laboratory. This study and thought, however, has caused me to come to the following conclusions, which I believe will agree with the clinical experience of every careful observer.

I believe that the initial process in the decomposition of the pulp tissue is one of *fermentation,* which is brought about by the action of micro-organisms upon the carbohydrate constituents, producing among other compounds such acids as carbonic, H_2CO_3 (H_2O+CO_2), and acetic, $HC_2H_3O_2$, depending largely upon the micro-organisms present in the tissue. This creates an acid medium which favors the action of those micro-organisms, here ever present, which have the power to decompose the complex proteid molecule in such a medium, and the process of *putrefaction* is thereby inaugurated. Among the first products produced are hydrogen sulfid, H_2S; putrescin, $C_4H_{12}N_2$, and two isomeric substances, cadaverin and neuridin, $C_5H_{14}N_2$. As the process goes on, these latter substances are gradually broken up, and ammonia, NH_3, or derivatives of ammonia, are evolved.

I have been led to believe, also, that the fatty constituents remain practically unchanged in the entire fermentative

and putrefactive processes, and that they exist in the putrescent mass of a pulp-chamber and the root-canals. The bacteria may split up neutral fats into glycerin and fatty acids, but other than this no change seems to occur. Every chemist is familiar with the fact that carbohydrates are unstable compounds; that they readily undergo the process of fermentation; and that neither an acid nor an alkaline medium is essential for the action of the exciting agent, whether it be a ferment or a micro-organism. It is also well known that proteid substances are easily putrefied by micro-organisms in the presence of the proper temperature, moisture, and an acid medium—all of which are present in a pulp-chamber after the process of fermentation has begun. That fats are emulsified or saponified by alkalies, or ferments in an alkaline medium, is also a well-established fact. Such a medium, I believe, in the pulp-chamber of a tooth never exists from the time the fermentative process begins until the putrefactive process is complete.

THE END PRODUCTS.

It is well to remember, then, that early in the process of pulp-decomposition the carbohydrate and proteid or albuminous constituents are decomposed, and that the chief final products are water, carbon dioxid, ammonia, acetic acid, and a semi-putrid substance which, for reasons mentioned, I believe is largely composed of fats, depending upon the extent to which the process of decomposition has progressed. It should be remembered, too, that simultaneously with the breaking up of the pulp tissue the dentinal fibrillæ are also decomposed, and that the dentinal tubuli, as well as the pulp-chamber and root-canals, are filled with the end products of the decomposition, together with little globules of fat or fatty acids.

Having stated what seem to me to be the chief final products of pulp-decomposition, and therefore the compounds with which we have to contend in the treatment of these cases, I beg permission to direct your attention to this phase of the subject:

COAGULATING AND NON-COAGULATING AGENTS.

Those of you who have read the literature of our profession for the past ten or fifteen years know that the opinions of many investigators in regard to the penetrating or non-penetrating power of coagulating agents in a putrescent root-canal are many and varied. The reason for this variance of opinion I have never been able to understand. Many of the leading men of our profession have objected to the use of coagulants in the treatment of putrescent pulps and abscesses without a fistulous opening, for the reason that such agents will, in their opinion, coagulate the albumin present and thereby prevent their penetrating the contents, and that the coagulum is also liable to close the small root-canals. On the other hand, there are many who assert that albumin, though present, does not prevent the penetration of coagulating agents, and that such takes place throughout the pulp-chamber and root-canals as well as the dentinal tubuli. Both sides attempt to sustain their theories by many laboratory experiments. Those who object to coagulants in the treatment of these cases adduce the coagulating action of such agents upon the albumin of a fresh egg. But the

conditions here are not at all similar. Should an egg which has undergone the process of decomposition be substituted for a fresh egg it will be noticed that no coagulum is formed—for the simple reason that the proteid constituents (coagulable material) have lost their identity by chemical decomposition, and new compounds with entirely different properties have been formed. This explains, too, how the advocates of the penetrating power of these agents have seemingly succeeded in sustaining their theory. It has been shown that coagulating agents, in contact with egg albumin in sealed capillary tubes, penetrate the entire mass; and that the action of these agents is self-limiting only up to the quantities used. By sealing these agents in extracted teeth with the cementum removed and embedded in plaster, it has been shown also that they penetrate the entire tubular structure. These experiments prove conclusively that coagulants will penetrate the putrescent mass of a root-canal, but do not prove, to my mind, that albumin as such is here present. I am not anxious to antagonize either side in this controversy, but it is a subject, as I have previously mentioned, in which every practicing dentist must be interested, and yet one which seems never to have been successfully settled. It seems to me, therefore, that we should not be over-anxious to criticize each other's views, but each should study the chemistry of pulp-decomposition and thereby acquire a knowledge of the chemical facts relating thereto. It is by this method only that this subject can be scientifically mastered.

A RATIONAL TREATMENT.

In selecting drugs, then, to be used in the rational treatment of these conditions, I shall eliminate the question of coagulation, and select agents with reference only to their ability to unite chemically with the end products resulting from pulp-decomposition. In this connection we should remember that the putrescent condition has been brought about through the agency of micro-organisms by a gradual analytic process; that many of these germs are pathogenic in character; and that among the first products of importance are hydrogen sulfid, putrescin, cadaverin, and neuridin. The last-named compound, being non-infectious, is of little importance, other than to know that it is a nitrogeneous substance from which ammonia is evolved by further putrefaction. Still, according to Vaughan and Novy, while pure neuridin is non-poisonous, it possesses a toxic action as long as it is contaminated with other poisonous products of putrefaction. This holds true for all non-poisonous bases. Hydrogen sulfid is important because it is an *acid gas* with a disagreeable odor, having local irritant properties, and also because of the part it plays in the discoloration of the tooth-structure. However, I must say here, that while I realize that hydrogen sulfid is an active chemical agent, in my opinion it has been greatly over-estimated in the rôle it assumes in the discoloration of teeth from the decomposition of the pulp tissue. Putrescin and cadaverin are perhaps the most important compounds, in so far as the correction of the putrescent condition is concerned, known to be formed in the splitting up of the proteid molecule. Like neuridin, they are basic nitrogenous compounds, capable of undergoing further putrefaction, evolving ammonia; but, unlike this compound, while they were at first regarded as physiologically

inactive, both these bases have been proved by Scheurlen, Grawitz, and others to be capable of producing inflammation and necrosis.

Among the gases produced, then, in pulp-decomposition are carbon dioxid, ammonia, and hydrogen sulfid. As these gases are evolved in those cases where there is no free exit from the pulp-chamber through a cavity, pressure is produced, and in many instances they escape through the apices of the roots, carrying the poisonous ptomains into the surrounding tissue; inflammation is thereby produced and an alveolar abscess established.

In those cases where we open into the pulp-chamber and find a pulp undergoing the process of decomposition, and when the ptomains and end products have not been forced through into the apical tissue, our treatment should be to at once *hermetically* seal into the pulp-chamber an agent which is volatile and thereby penetrating, and which, as it comes in contact with the end products, will unite chemically, converting them into odorless and non-infectious compounds. Such an agent we have in formaldehyd, CH_2O, a gas which occurs in commerce in a forty per cent. aqueous solution known as "formalin."

It has long since been known that ammonia is one of the chief end products in the splitting up of the proteid molecule. It is also known that formaldehyd unites with ammonia to form a solid compound, which is odorless, colorless, and has a sweetish taste, known commercially as urotropin, chemically as hexamethylene-tetramin, with the chemical formula $(CH_2)_6N_4$. It is stated also on good authority that formaldehyd unites chemically with hydrogen sulfid and basic ptomains, forming inodorous compounds. Formalin, however, is too strong a solution for our general use; therefore, believing that the fats remain practically unchanged in the process of decomposition, I have been using cresols, in combination with formalin, which act chemically upon the fatty constituents. Cresols are homologues of carbolic acid. There are three—metacresol, orthocresol, and paracresol. The product best suited for our use is *tricresol,* a refined mixture of the three. It is a nearly colorless liquid, of a creasote-like odor, and is soluble in water to the extent of 2.5 per cent. Tricresol has been selected as the vehicle with which to dilute formalin for three reasons:

(1) It is miscible with formalin in all proportions, thus making a good pharmacal product.

(2) It is a good germicide—nearly three times as powerful as carbolic acid.

(3) It acts chemically upon the fatty constituents, thereby properly disposing of these substances.

The formula which I have been using with gratifying results in the treatment of putrescent pulps is—

A

℞—Tricresol,
Formalini, āā f℥j (gm. iv). M.

Sig.—On a small pledget of cotton, hermetically seal in the pulp-chamber from twenty-four to forty-eight hours. One treatment is generally sufficient.

In the treatment of abscesses without a fistulous opening it is well to modify this formula. In these cases the decomposition of the pulp tissue is complete. The intermediate products (ptomains) have largely been broken up, pus has been formed from the tissue surrounding the ends of the roots, and the first step

in treating such an abscess is mechanically to evacuate the pus. We have no necessity for using formaldehyd, then, in the same strength solution as in those cases where the pulp-chamber, root-canals and tubuli are filled with the putrescent material. The point I desire to impress is that formaldehyd in this strength solution *must* be confined to the tooth-structure, for it is one of the most irritating agents known to the therapeutist. A safe formula for abscesses without a fistula is—

B

℞—Tricresol, f℥j (gm. iv),
Formalini, f℥ss (gm. ij). M.

Sig.—Mechanically evacuate the pus and, on cotton, hermetically seal in the canals from twenty-four to forty-eight hours, two or three times—oftentimes one treatment is sufficient.

EXPERIMENTS.

(I) Add to 5 cc. of strong ammonia water 3 cc. of formalin. A violent reaction takes place, forming urotropin $(CH_2)_6N_4$, which dissolves in the water:

$$4NH_4OH+6CH_2O=(CH_2)_6N_4+10H_2O.$$

The clear solution is evaporated, using moderate heat during the last stages of the process, when the urotropin is obtained as a white, crystalline solid.

(II) Pass a stream of hydrogen sulfid into 5 cc. of formalin for a few seconds. The odor is at once destroyed. This proves that a reaction takes place. I hold that methyl alcohol, CH_3OH, is formed, and sulfur is liberated:

$$2CH_2O+2H_2S=2CH_3OH+S_2.$$

On evaporating the solution to dryness, the methyl alcohol burns, leaving the sulfur, S, as a residue.

Tricresol, besides its germicidal power, dissolves the fatty globules which, if treated with alcohol (as is usually done in drying the canal) produces *lysol,* a good antiseptic. It is plain to be seen, then, that the poisonous gases and liquids resulting from pulp-decomposition are converted by the proper use of formaldehyd and tricresol into non-poisonous liquids and solids which are themselves antiseptic and germicidal in character. How can we imagine a more thorough sterilization of the dentin than to chemically produce within this tubular structure substances which possess these properties?

Thus I feel justified in speaking of the use of this remedy as a *rational* treatment for the conditions under consideration. Marvelous results are obtained, and at the same time we know why.

It should be remembered that the formulas given are for general use. The practical dentist will soon find that it may be best to vary the proportion of the ingredients of the mixture according to the case at hand. One great advantage in using remedies containing formaldehyd is that the medicament must be hermetically sealed in the tooth in order to obtain the best results. This prevents the saliva from contaminating the medicine within the tooth, and the medicine from contaminating the saliva in the patient's mouth.

The use of neither formaldehyd nor tricresol alone is original with the writer. I have studied the action of drugs, trying to place the treatment of these conditions upon a rational basis, and am gratified to know that such has been accomplished by the combination of formalin and tricresol in the manner which I have suggested.

In conclusion, I desire to say that

many of the statements made in this paper are based upon well-established chemical facts; therefore I cannot lay much claim to originality. However, I have endeavored to make a correct application of the chemical principles involved. The theory in regard to the decomposition of the pulp tissue may seem, perhaps, not to have been scientifically demonstrated; but it is the result of my laboratory investigation, and also is in harmony with my close clinical observation. As such, I present it to you for your consideration.

Discussion.

The CHAIRMAN. You have heard this excellent paper read. I take pleasure in calling on Dr. Harlan, who will discuss it.

Dr. A. W. HARLAN, New York, N. Y. I did not come here to oppose the paper of Dr. Buckley, or to condemn it, or to taboo it; but I came to say something concerning the subject that he has written upon. The subjects of pulp-decomposition and the handling of pulpless teeth have engaged the attention of the dental profession for a great many years. Since the discovery in 1836 by Spooner that arsenic would destroy the pulp of a tooth (although it was known many years before that the pulps of teeth could be destroyed by the action of cauteries, or destroyed by the use of corrosives and the invasion of caries, and perhaps by other means), we have had an absolute universally reliable adjunct through which a pulp could be destroyed. Running along from 1836 to 1890 or thereabouts the methods of handling the pulp were various. At that time was presented the proposition of Schrier of Vienna, the kalium-natrium process for the treatment of infected root canals. According to that method the pulp tissue was to be saponified and removed, and during the process of saponification nothing would happen. According to the researches of Frey, Boll, G. V. Black, Caush of Brighton, Eng., and Choquet of Paris—I don't know whether I can include Miller in that list or not—they did not discover that there were lymphatics in the pulps of teeth or that there was fat. If the process of Schrier for the saponification of pulps was based upon the theory that there were fat-globules in the pulp tissue—and the microscopists, such eminent men as I have mentioned, have failed to discover that there was any fat in the pulp—then what becomes of the theory of Schrier? It may be that there is fat in the pulp, and it may be that there is some fat to be saponified—I am not enough of a microscopist to determine it for myself; I have not made any sections of pulp tissue or made any analysis of pulp tissue to discover whether there is any fat in the pulp tissue or not. Dr. Buckley says in his paper that he has not been able to discover that pulp tissue differs in any way from animal tissue elsewhere.

Dr. BUCKLEY. So far only as the chemical constituents are concerned.

Dr. HARLAN. Yes; that is, if by synthesis the chemical constituents will produce fat, then we have a synthetic fat, just as we are able to produce synthetic carbolic acid, C_6H_5HO. It is true that we can get a synthetic carbolic acid that does not have a red color, especially if produced in vessels that are only glass. Now, if any process for a treatment of putrescing or putresced pulp be based

on the fact that there is fat in that pulp, then the fact of its presence in the pulp must be demonstrated. I do not say, mark you, that there is not any fat; I am only quoting these gentlemen who have investigated that subject.

I read this paper a week or two ago; Dr. Hodgen sent it to me from San Francisco, and I have looked it over. The paper of Dr. Buckley as a whole is very interesting, clever, and striking, and I thoroughly commend it, as well as his modesty in saying that the use of formalin and triciesol is not original with him. His modesty and frankness are extremely commendable. Most men who get up and read these papers forget that others have preceded them. Formalin and tricresol were both used in general surgery before Dr. Buckley was born as a dentist, and therefore I wish to commend that particular feature of his paper.

Dr. Buckley's presentation of this subject, so far as I know, with reference to formalin, putrescin, and neuridin is in consonance with Aitken's "Animal Alkaloids" and Klein's "Micro-organisms," both of which works I have had occasion to consult, not recently but in times gone by. We all think we are making great progress, but you must remember that it takes years to demonstrate a thing. As Dr. Cassidy said a little while ago, we have to rearrange our views. I remember very well it was thought formerly that all you had to do was to open into a putrescent pulp and put a little carbolic acid in there, and that was all. Or, if that were not done, some iodin and creasote were applied and that was considered all that was necessary. Now we know, as Dr. Buckley has clearly demonstrated, that after the decomposition of the pulp takes place, there is no albumin in the pulp-chamber—there is only albuminous matter in the pulp itself before the decomposition has taken place; and so if carbolic acid, creasote, or zinc chlorid be applied shortly after the death of the pulp and before decomposition has begun, it can coagulate and shrivel it, and perhaps if the agent be powerful enough it may convert it into an ash and incinerate it, perhaps absolutely destroy it. But the men who have been working on those conditions have been mistaken. A coagulating material will not coagulate something that is not coagulable. Dr. Buckley has made that clear.

Dr. Truman presented a series of experiments in Philadelphia in 1894 to prove that a coagulating agent would absolutely penetrate everything. I took the trouble to take twenty or thirty or fifty freshly extracted teeth and drop them into a solution of silver nitrate and leave them for a month, and I found on examination only a surface coagulation, because there was an absolute pericemental membrane surrounding these teeth, and it stained only the surface of the teeth and would not go any farther. So that, under certain circumstances, when you have a coagulable material and a coagulator, just as soon as the affinity of that coagulator is satisfied by the water that is present the process stops—the coagulating process does not go any farther. Dr. Bethel, who is not here today but ought to be, presented some experiments at Saratoga in 1895, in which he showed conclusively that, if silver nitrate be introduced into the root of a tooth, acting as a root-filling and a preservative for any pulp tissue that remains, it only produces a superficial stain or discoloration. Consequently, I do not consider, from a strictly chemical and scientific standpoint, that the advo-

cates of the coagulative agent under all circumstances and conditions, have proved their case; because, with the aid of Dr. Good of Chicago, one of my assistants in the Chicago college, we took a number of people and forcibly removed the pulps of the teeth, and in other eases destroyed them and filled the canals with carbolic acid and zinc chlorid when they were in the mouth, and within twenty-four or forty-eight hours extracted them; and then we tested those teeth outside of the mouth to see if any trace of earbolic acid had penetrated. We were unable to find where it had penetrated through the dentin, because the process of decomposition, as Dr. Buckley has presented here this afternoon, had not had time to take place.

Therefore it is a mistake to suppose that the instant you put carbolic acid or creasote or zinc chlorid or silver nitrate in a tooth it will penetrate immediately through the dentin before the process of decomposition has begun. That was the point I was making; and Dr. Buckley deserves our thanks for presenting in such a clear and concise manner the idea and fact that you cannot coagulate something that is not coagulable—because it is not there, it has been decomposed, and it is a new substance that you must deal with. Therefore the use of a coagulating agent and the penetrability of it through the dentin does not prove anything when the cementum has been filed off or cut off.

The conclusion Dr. Bueklev comes to with reference to the admixture of tricresol and formaldehyd in forty per cent. solution, according to chemistry, is absolutely correct. I have nothing to say about that exeept that I thoroughly and heartily commend that portion of the paper as well as the other portions: and I know just as well as he does, and Dr. Hodgen, and my old friend and teacher Dr. Cassidy, that formalin and formaldehyd are among the most irritating substances that can be brought into contact with the soft tissues, and therefore you have to modify them. And I also commend the statement that those things must be sealed as hermetically as possible; they are so freely soluble in water that they would soon be *nil* unless they are sealed.

I will repeat that I did not come here to combat Dr. Buckley's paper, but I do not consider that it is proved that we have fat in the pulp, according to the investigations of the gentlemen I have mentioned; and if that is a mere assumption, then that part ought to be corrected.

Dr. Cassidy being requested to take the chair, Dr. Hodgen continued the discussion of Dr. Buckley's paper, as follows:

Dr. J. D. Hodgen. First, I wish to congratulate the dental profession in its having among its number a man sufficiently acquainted with the subject of this section to present a paper so clearly chemical and yet so strictly applied to dentistry as the one we have just had the good fortune to hear. I wish also to say that my own views are very much in accord with the essayist; and that, while I may differ in the treatment of putreseent pulp-eanals, I wish in no way to be understood as criticizing the practical and scientific treatment whieh has been so clearly outlined. If your patience will permit, I will briefly review a portion of the histo-chemistry, which, although it has been mentioned by the essayist, I find necessary to a complete elueidation of the method of treatment I am about to ex-

plain. I claim nothing new or original in what I speak upon, but in truth there is even more in it—something of even greater value to the scientific phase of our profession. The burden, therefore, upon your patience consists of my attempt to illustrate the application of pure chemistry to practical dentistry.

From a histological examination of the dental pulp we find it made up of connective tissue, nerve tissue, vascular tissue, and blood. Then, as has been admirably set forth in this excellent paper, we observe from a chemical examination of these tissues that they are clearly analogous with all other animal tissue in that they are made up, from a general point of view, of nitrogenous and non-nitrogenous substances; moreover, that the nitrogenous substances are protein or albuminous bodies composed of about 50 per cent. carbon, 6.5 per cent. hydrogen, 15 per cent. nitrogen, 21 per cent. oxygen, 0.3 per cent. sulfur, with occasionally a small amount of phosphorus, or even iron, in their make-up. It is also true that while the chemist can approximate a percentage composition of these protein and albuminous bodies, no one as yet has been able to state the definite chemical composition of any, not even the simplest of them. It is, however, none the less true that we recognize in these protein substances the chemical substrata of animal life.

In recalling the proteins which are most prominent in the make-up of the various histological structures of the pulp, our attention is particularly drawn to four, viz, fibrin (as a simple proteid), hemoglobin (as a compound proteid), and collagen, elastin, etc. (as albuminoids).

As has been said, the non-nitrogenous compounds of the pulp tissue are the fats (carbohydrates), composed of varying amounts of carbon, hydrogen, and oxygen in known definite chemical combinations. With these we are more familiar than with proteins. Theoretically, we say that all true fats are compound ethers of the triatomic alcohol glycerin, in which the three replaceable hydrogen atoms of the hydroxyl are replaced by three univalent radicals of the higher members of the fatty acids. The most important fats found in the pulp tissue are tripalmitin, $C_3H_5(C_{16}H_{31}O)_3O_3$, stearin, $C_3H_5(C_{18}H_{35}O)_3O_3$, and olein, $C_3H_5(C_{18}H_{33}O)_3O_3$.

Now, without being too exact, we may call your attention to the fact that the pulp organ is, from a chemical point of view, made up as follows:

Proteins and albuminoids.	*Fats.*
Fibrin,	Tripalmitin,
Hemoglobin,	Stearin,
Collagen,	Olein, etc.
Elastin, etc.	

From some cause the pulp organ is injured, becomes gangrenous, dies; passing through a number of changes, it finally reaches the putrefactive stage so frequently encountered in routine practice. We have seen what the healthy normal pulp organ may be like, histologically and histo-chemically. But, more essentially, what is it, as we find it putrescent and poisonous in chamber and canal of the natural tooth *in situ?* In other words, when these normal pulp tissues decompose, what chemical change takes place? What is putrescent pulp tissue, chemically?

All organic bodies passing through the natural changes—decay, fermentation or putrefaction—are resolved into simpler compounds, elements, or substances. Leucin, an amido-acid having the formula $C_5H_{10}NH_2COOH$, is the constant prod-

uct of the cleavage of proteins. Tyrosin is nearly as constant an end product of proteins as leucin, and is another of the amido-acids, having the formula $C_6H_4OHC_2H_3(NH_2)COOH$. Leucin is quite soluble in water, and, though tyrosin is only sparingly soluble, they both are very soluble in alkaline solutions and could be gotten rid of by the agency of the latter.

As a matter of fact, these like all complex organic bodies split up into simpler substances. As might be imagined from their constitution, fats are one of their end products, the others being for the most part gases, such as ammonia and its compounds, sulfuretted hydrogen, nitrogen, etc. As we are all aware, it is these gases that cause the immediate trouble; but if the canal be opened into they escape, and the pain caused by their pressure disappears for the time being.

Now we have left for consideration the fats, embodying in their glycerin mass naturally more or less of these end product gases in solution, micro-organisms of putrefaction, undecomposed substance, etc.

Chemistry presents many reagents for the transformation of fats, but nothing so common, so simple, and so practical, as the action of the alkalies. The old-fashioned housewife on the farm, with the lye extracted from the wood-ashes and the fats from the kitchen, made the soap for the family. In sodium dioxid, Na_2O_2, we have a chemical reagent as a remedial agent, which presents a threefold value:

First: As a saponifier of the fats left in the pulp-canal.

Sodium dioxid is very deliquescent, and as soon as it comes in contact with water, breaks up, forming sodium hydroxid, and liberates oxygen:

$$Na_2O_2+H_2O=2NaOH+O.$$

If there be any leucin or tyrosin present, these are dissolved in the alkaline solution. The fats present (tripalmitin, stearin, or olein) are saponified by the hydroxid, and thus are not only soluble but as soap act as a cleansing agent in the canal:

$$\underset{\text{(sodium hydroxid)}}{3NaOH}+\underset{\text{(tripalmitin)}}{C_3H_5(C_{16}H_{31}O)_3O_3}=$$

$$\underset{\text{(soap)}}{3NaC_{16}H_{31}O_2}+\underset{\text{(glycerin)}}{C_3H_5(OH)_3}.$$

The glycerin, of course, is soluble, and is therefore washed out.

Second: The nascent oxygen liberated from the Na_2O_2 disinfects any remaining tissue in the canal and dentinal tubuli, leaving, after thorough treatment, the tooth pure and wholesome.

Third: Furthermore, the escaping of the nascent oxygen from the liquid or semi-liquid mass, affords a mechanical assistance in freeing the tubuli, canal, and chamber of its putrid mass.

That nascent oxygen is the greatest possible disinfectant, the most natural, least irritating, and in every way best indicated for the mouth and oral tissues, is not questioned. The only question is whether a sufficient amount of it can be liberated in the canal and chamber. Let us examine the compound Na_2O_2 for a moment, to determine the amount of available oxygen stored there:

$$\begin{array}{l} Na_2—23\times2=46 \\ O_2\ —16\times2=\underline{32} \\ \qquad\qquad\quad 78 \end{array}$$

$$78 : 32 :: 100 : (41)$$

$41\div2=20.5$ per cent. of available oxygen in sodium dioxid. Let us see what this represents in volume.

Take, for instance, 1 mgm. of sodium dioxid; that much with care could be

used at a time in a pulp-chamber; 20 per cent. by weight of that 1 mgm. is available oxygen, or $\frac{1}{5}$ mgm. in weight. A liter of hydrogen weighs 0.0896 gm. One liter of oxygen weighs 16 times a liter of hydrogen ($16 \times 0.0896 = 1.4336$ gm. *n. t. p.*); therefore, $\frac{1}{5}$ mgm. would occupy in volume 1/5000 or $\frac{1}{5}$ cc., enough to fill scores of canals. By no other means can so great a volume of nascent oxygen be obtained *in situ.*

We can better comprehend what this means and what it will accomplish as a disinfectant when we compare it with other opportunities of obtaining nascent oxygen, knowing what can be accomplished by them: The aqueous solution of H_2O_2 is about 3 per cent. The ethereal solution of H_2O_2 is furnished us as high as 25 per cent., but it is very difficult to handle. Na_2O_2 furnishes 20 per cent. of nascent oxygen, and anyone can handle it—exercising no more than ordinary care.

Such a treatment of putrescent canals is, to my mind, not only chemically and scientifically indicated, but it is reasonable, it is practical and it is logical.

I fear I have tried your patience with my rehash of the sodium dioxid treatment. No doubt all are perfectly familiar with its use and action, but, as I have said, its use is so clearly scientific and so practical that I could not refrain from recalling it to your attention. More than that, it affords an excellent example of how practical chemistry may be applied to practical dentistry.

In regard to the care and treatment of root-canals and the use of such substances as zinc chlorid, silver nitrate, carbolic acid, and the like, and of the volatile oils, I can but have this to say—much in support of what Dr. Harlan has said. Zinc chlorid, silver nitrate, and carbolic acid belong to a class known as coagulating antiseptics, and in a putrescent canal they are worse than useless; they are not only largely incapable of penetrating their own coagulum, and thus valueless in deep-seated putrescent conditions, but in their action they seal up the putrescent contents of the dentinal tubuli, thus making such contents a source of much irritation to the peridental membrane. To my mind they are, however, useful and are indicated in the case of canals from which the pulp has been extirpated while alive, as in the instance of cocain anesthesia, or in those from which the pulp has been removed before putrefaction or infection. Used in such a manner, coagulating antiseptics are indicated *because* of their coagulating property. They seal up the contents of the dentinal tubuli and largely prevent the putrefaction and infection of such contents.

On the other hand, volatile antiseptics are indicated in putrescent canals much as germicides, disinfectants, and antiseptics; the purpose of their use, owing to their volatile properties, being to disinfect and keep clean the tubuli until the canal can be permanently filled.

Dr. Hodgen then resumed the chair, and called upon Dr. Cassidy.

Dr. J. S. Cassidy, Covington, Ky. When a man devotes time and intellect to the preparation of such a paper as Dr. Buckley has presented to us today, it strikes me I should be on dangerous ground were I to attempt a criticism of anything he has stated in his paper. I am glad Dr. Buckley did not read his paper ten years ago, for if he had, it seems to me, I should have missed much in listening to the papers and discussions as to coagulums between Dr. Harlan and Dr. Truman. Dr. Buckley would have

settled the question so that there would have been nothing left to discuss. So I shall have to remain satisfied today with complimenting Dr. Buckley's paper, and the chairman's also. I thank you both and congratulate you.

The CHAIRMAN. If there be nothing further on this paper, we will listen to the reading by the secretary of a paper by a gentleman from Japan, Dr. SEKI-ICHI ENOMOTO of Tokio, on the subject of "Annealing Gold."

The Secretary accordingly read the following paper:

Annealing Gold.

By Dr. SEKI-ICHI ENOMOTO, Tokio, Japan.

EVERYONE knows that the slightest carelessness in the preparation of gold for filling teeth would jeopardize its working quality. Its softness, its adhesiveness to the cavity, its strong resistance to chemical reaction and mechanical wear, with the other advantages that make this metal the best filling material, are often totally impaired during its preparation as such.

In my long practice I have seen many gold fillings, and found them in a quite different condition than they were in at the time of filling. In some cases the upper layer flaked off, while in other cases the thin surface was pitted, such deterioration occurring both in new and old fillings. All these instances show that the requisite qualities of gold were lost. It would be no wonder if they occurred only in the work of inexperienced dentists; but the fact is that they frequently occur in fillings made by dentists of long experience and good standing.

The pure gold foils when heated become cohesive, so that when touched to each other they will adhere and not easily separate. Then what does the deterioration of the gold filling mean? Sometimes the cohesive power is injured by moisture, sometimes by the protrusion of the gold from the cavity, sometimes by excessive hammering of the surface of the filling, or by an unskilful use of the plugger point. But these are not often the chief causes of such deterioration. I believe the defective method of annealing gold, and consequently the use of gold not perfectly soft and cohesive, is responsible for the poor work. Let us briefly review the method of annealing gold pursued by the dentists of the day. The methods, I believe, can be grouped into three classes, viz, direct, indirect, and electric.

By annealing in the direct flame we mean the method of annealing gold pellets by bringing them in contact with the flame of an alcohol lamp or Bunsen burner. Usually a pellet is held in the flame with the pliers, or a fork-shaped instrument, or the plugger point. Each of these methods has one and the same defect, that the pellet is not homogeneously annealed. This defect is most evident in the case of the pliers. The end of pliers cannot be easily heated, and by the time it has been heated sufficiently to anneal that part of the foil touching the pliers, the farther side of the foil

fuses and forms a mass which is not sufficiently soft. If the pellet be not sufficiently heated for fear of the formation of a mass, it will not be sufficiently cohesive, and we shall have to use the pellets imperfectly annealed. We often mistake its stickiness due to the heat of its annealed condition, and make up for the imperfection of annealing by the mechanical use of the plugger. Usually it occurs that one-fourth is left imperfectly annealed. To perfect the annealing we must take up the pellet a second time, holding it by the annealed part. But this process is almost impracticable, except for the most skilful operator; the ordinary operator, I fear, will most probably fuse the pellet or else pass it too quickly over the flame. It is probable that the moisture of the flame will be absorbed in a part of the foil before sufficient heat will have dried up its moisture. It is a hard problem even for a skilled operator to distinguish a suitable annealing from stickiness.

The substitution of a plugger point or other instrument for pliers, though differing in width, makes no difference from the fact that the gold cannot be impartially annealed. In addition, the pellet when held by such an instrument often falls in the flame or on its way to the tooth. These circumstances of the application of half-annealed and melted mass pellets for filling the teeth will never prove a success. I have good reasons for believing that the poor results after filling are entirely due to the deficiency of the annealing method.

Annealing by the indirect flame is the method of annealing gold pellets by placing them upon a metallic or mica tray over the flame of a Bunsen burner or an alcohol lamp. The superiority of this method to the former is, first, that no particular portion of the pellet will melt directly by the flame, and second, that it will be comparatively uniformly annealed by the heat through the tray. Its demerits are, first, the impossibility of determining the degree of annealing by the color of the pellet in daylight; second, the fact that an equal heat cannot be given to the pellet by the tray, which will be heated in different degrees owing to the movement of the flame due to the movement of the air, which the screen on one side of the flame cannot prevent; and third, as the pellets are exposed to cold air on their upper side and the other side is in direct contact with a strong heat, the defect is such as in the case of meat being roasted in an uncovered pan. Under these circumstances, insufficiently annealed and therefore insufficiently cohesive pellets will be placed into the filling, with the result that they will flake off later owing to the friction. This is another cause why a filling of improperly annealed gold is not a success.

The *electric gold annealing tray* was devised by Dr. L. E. Custer of Dayton, Ohio. The apparatus for annealing gold according to this method consists of a table having many square hollow partitions of different sizes providing for the pellets. By turning the electricity on, the gold would become perfectly annealed on both sides equally, without any injury to its efficiency. To one end of the partition a wire is connected for the electric current. The contrivance of the doctor is popularly approved as the best method of the day for annealing gold most evenly. But the scheme can be appreciated only by people who live in a city where they can get a supply of electricity during the day, and operators in less favored localities cannot participate in

this advantage. The use of the galvanic battery for this purpose is too expensive and involves too much work to be universally used.

To summarize the defects attending the before-mentioned three methods of annealing: The direct and indirect methods are too defective, and the electric method is rather impracticable, though superior to the others. In view of the deterioration of gold fillings, I have devised an apparatus for annealing gold. It is a modification of the indirect method of annealing. The apparatus has a cover which prevents cold air from reaching the gold foils and insures the annealing of them uniformly on both upper and lower sides. This prevents adulteration and develops its efficiency in the highest degree. The apparatus is entirely inclosed, with the exception of small holes through which air is supplied for the flame of the alcohol lamp inside, and thus the flame is prevented from wavering to and fro by any slight movement of air. The wick usually used for the alcohol lamp being too small to spread the heat under the whole surface of the tray containing the pellets, I have made use of a larger wick and placed it so as to heat the tray uniformly and in a shorter time. On one side of the annealer I have attached a second burner accompanied by a tray and a screen, on which the annealed foil is gradually cooled. According to Dr. Black's theory the cohesive power of gold will last for about an hour after it has been annealed, after which time it will gradually decrease. Experience shows that the warm pellet is more soft and retains more cohesive power than the cool one, hence this accessory apparatus has been added.

This apparatus is accompanied by three kinds of trays—of metal, of mica, and of sheet asbestos on a metallic tray. According to my experience the mica tray requires three or four minutes for perfect annealing; the metal tray about four minutes; and asbestos-metal tray five minutes—the time required for annealing depending chiefly on the thickness of the pellet.

The lower part of the annealing apparatus contains the alcohol holder, with the wick in the center. The tray is placed above the wick just beneath the cover. The apparatus has a door in the middle of its side to enable the operator to light the wick. The mica in the front part of the cover allows one to see the color of the gold as it is being annealed. A handle is attached to the cover by which it is easily removed with a plugger point. The screen protects the flame on its lateral sides and the tray above, with shelter at the sides.

The advantages of this apparatus, in my opinion, can be enumerated as follows:

(1) The lamp being entirely inclosed with the exception of the holes for passage of air, the heat emanating from the flame pervades the whole of the inside of the apparatus and prevents the adulteration of the gold from exposure to the cold air, which was one of the defects pointed out in the indirect annealing method. The cohesive and flexible nature of the gold is improved by this process.

(2) As the construction is such as not to allow the slightest movement of air inside the apparatus, the whole of the tray and the pellets on it are uniformly heated, and none of the gold will be left imperfectly annealed.

(3) It enables one to find a certain invaluable standard of the time and of the degree of heat required for annealing. Thus the defects of direct and indirect annealing are overcome.

(4) The operator using this apparatus has the satisfaction of being able to finish his work in a shorter time. He has no need to wait, after using a trayful of pellets, for the annealing of another trayful, he being able by means of this apparatus to use one trayful of annealed pellets while another is being annealed. The shortness of the duration of the operation is a very important thing to the patient, who is made extremely uncomfortable by the presence within his mouth of the rubber dam and clamp. We must of course sympathize with patients who are subjected to these uncomfortable gags.

(5) Alcohol, the source of heat in this apparatus, is easily procurable, while electricity, which is somewhat closer to our requirement, is difficult to obtain. A supply of electricity is obtainable in most cities, but in some the supply cannot be obtained except at night; and the substitution of a battery for this purpose is too expensive and involves too much work.

I humbly submit this scheme for criticism and for liberal suggestions, as I fear my self-confidence may lead me to overlook defects which it is possible may exist; and I hope, at least, that this method will afford some convenience to dental practitioners.

Discussion.

Dr. A. W. Harlan, New York, N. Y. Dr. Black presented the first paper on annealing gold in 1869 at Bloomington, Ill., and until Dr. Custer presented his method of annealing gold with electricity, all sorts of schemes, not including the present method, have been used. They used mica covers, old pieces of Russia iron over lamps, and everything like that. I know this is true, because I was a student of dentistry at the time.

The Chairman. Is there any further discussion desired on this paper? If not, we will pass to the next—which, very unfortunately, must be read by title. It is on "The Uses of Aluminum," by Hof-Zahnarzt W. Pfaff, Dresden, Germany.

The paper in full here follows:

Aluminum: (*a*) Investigations Concerning its Corrosibility; (*b*) Its Applicability in Dentistry.

By Hof-Zahnarzt W. PFAFF, Dresden, Ger.

The subject here presented is one which has occupied my attention for a long time, and concerning which I have occasionally reported. This essay aims at giving information to the profession upon the following questions: (1) To what extent aluminum is affected by contact with the food and beverages ingested as well as with the fluids in the buccal cavity, and whether hygienic objections may be raised against the application of aluminum in the buccal cavity; (2) In what manner aluminum may be utilized to advantage in dental technics.

First of all I intend to discuss the experiences thus far published, and of which I have, of course, made frequent use in my own investigations.

The fluids which we have to consider in respect to the human organism—*e.g.* pus, saliva, perspiration—affect aluminum very slowly, while sulfuretted hydrogen and ammonia exert no influence whatever upon it. No more do the particles of aluminum that may have been dissolved affect the organism.

The first investigator who took up this question, was Paul Siem, in his inaugural dissertation "Concerning the Effects of Aluminum and Beryllium on the Animal Organism." Siem's first experiment was subcutaneous injection of a sodium-aluminum double salt in combination with lactic or tartaric acid into the organism of cats, dogs, rabbits, and frogs. These experiments, in most of the cases wherever sufficient quantities were used, resulted in the death of the animals from paralysis of the respiratory organs. Further—and this is of greater importance—Siem added to the food of the animals aluminum salts, for four consecutive weeks, 0.1 gm. daily. This addition caused, in the first week only, acute diarrhea; from the second week and forward the animals subjected to this treatment comported themselves perfectly normally. Even in the urine no traces of aluminum were to be detected.

Therefore, aluminum salts directly injected into the blood, act as a poison, exactly in the same manner as a great number of otherwise quite innocuous salts would do; on the other hand, aluminum is not absorbed by the healthy stomach and intestinal canal—as little as, for instance, the metals iron and manganese, in opposition to mercury, lead, arsenic, and beryllium—the latter likewise having been tested by the same investigator.

Luebbert and Roscher made investigations "Concerning the Applicability of Aluminum for some Articles of Use," and they without qualification declared aluminum to be unfit for vessels of any description, on account of its great solubility in both acid and alkaline fluids. The experiments were conducted in the following manner by the authors of the above-mentioned treatise; viz, by allowing pure aluminum foil to stand for four days in different concentrated solutions at the regular temperature of the room, for the purpose of analyzing the filtrate or the ash for aluminum. These experiments, though, are not very reliable—first, because of the use of aluminum foil, which chemically comports itself quite differently from plate aluminum—the first-mentioned substance being much more combustible and oxidizable; and secondly, the experimenters omitted to state how much of the surface was dissolved.

With this fact for a basis, the obvious question arises, How much aluminum may be considered to be innoxious—how much aluminum may be contained in the fluid, after liquid food has been kept during a night in an aluminum vessel? This question must be clearly decided before we can judge concerning the suitability or non-suitability of aluminum, since other metals also, even lead, are soluble in a number of organic fluids. In the Berlin waterworks, for instance, with constant regularity, traces of lead are found overnight; nevertheless no harmful influences could be ascertained. Thus G. Rupp, in an exhaustive treatise concerning the same subject, arrives at results widely different from those obtained by Luebbert and Roscher. Although he likewise found aluminum in the different fluids, but in extremely small quantities, Rupp does not hesitate to conclude as follows:

"Even when insignificant traces of aluminum in contact with foodstuffs and drinkables are absorbed, according to the results of my experiments, I feel safe in stating that hygienic objections are out of the question, considering the fact that using different kinds of food and beverages (as drinking-water) we introduce aluminum salts into the organism. In the same manner, using vessels made of copper, brass, tin, alloys of tin, lead, nickel, German silver, traces of these metals are incorporated into the food and beverages."

At about the same time G. Lunge and Ernest Schmidt in complete agreement have ascertained that aluminum may be unhesitatingly utilized for canteens and surgical instruments, since the power of chemical reaction of this metal is extremely low, and the absorption of such minute quantities of aluminum salts into the human body gives no ground for apprehensions of any kind.

Further, they undertook experiments concerning the solubility of aluminum by means of nitric acid. They obtained the following result, to wit, that after ten days' action of chemically pure nitric acid upon a surface of 100 square centimeters the following losses of weight of aluminum were registered:

Acid of sp. grav. 1.2: Loss of weight	1027.3 mgm.
Acid of sp. grav. 1.4: Loss of weight	399.7 "
Acid of sp. grav. 1.5: Loss of weight	37.8 "

That nitric acid will affect aluminum, when the metal is exposed to its action for some time, other experimenters have similarly demonstrated. The experiments by Koehler, "The Action of Nitric Acid and Sulfuric Acid on Aluminum," are deserving of special consideration. Koehler records the following loss of weight of the aluminum after the action of nitric acid for twenty hours upon 100 square centimeters of surface:

Concentrated nitric acid	80.5 mgm.
1 part nitric acid, 1 part water	80.5 "
3 parts nitric acid, 5 parts water	50.0 "
1 part nitric acid, 3 " "	19.0 "
Concentrated sulfuric acid (sp. gravity 1.83)	325.0 "
1 part sulfuric acid, 1 part water	187.0 "
3 parts " " 5 parts water	86.0 "
1 part " " 5 " "	30.0 "

According to Koehler the solubility of aluminum is not exactly inversely proportional to the percentage of sulfuric acid. These opinions of Rupp were confirmed, besides others by Prof. Dr. Clemens Winkler of Freiberg, who from the loss of weight of an aluminum spoon which had been kept in constant use for twelve years (avoiding strong mechanical action when cleansing the same) arrives at the conclusion that said spoon would be completely used up in 273 years. In this case it is evidently demonstrated that aluminum for articles of use may very well compete with other metals, for instance silver, as a longer duration of existence could hardly be claimed for silver spoons.

Concerning the deportment of aluminum under the influence of fats and fatty acids, Prof. E. D. Donath of Bruenn writes as follows: "It is beyond doubt that fat and fatty acids, even with free access of air, exert almost no influence on aluminum."

Concentrated carbolic acid dissolves aluminum with vivid, even turbulent, reaction and disengagement of hydrogen. According to Donath, pure carbolic acid, free from water, has no influence on aluminum; but with this an observation

of Zmerzlikoer does not agree; he found that aluminum was dissolved by carbolic acid with energetic development of hydrogen. These diverging results probably are explained by the diversity of the various kinds of aluminum on the market. Generally, the purity of the aluminum is of an importance not to be underrated as a factor of its durability, as has been especially demonstrated by Moireau. Pure carbonic acid, dry or moist, according to various experiments, has no influence whatever either on cast aluminum or pure aluminum plate. Water containing carbonic acid, even under strong pressure, shows very little action on aluminum. I made an investigation to study the influence of saliva on aluminum, for this purpose ascertaining the loss of weight of an aluminum plate which had been for several weeks carried in the mouth; the loss of weight did not even amount to one-ninth of one per cent. To the assertion that saliva causes sieve-like perforations I have to revert later on.

The influence of beer on aluminum is, according to a Bavarian opinion, not worth mentioning. This opinion calls special attention to the surpassing suitability of aluminum for the preservation and transportation of large quantities of beer.

Dr. Plegge, in his work concerning canteens and cooking utensils made of aluminum, very appropriately shows that neither from a practical nor economical standpoint could essential objections be raised against such flasks, and that from a sanitary standpoint the use of the same appears to be beyond reproach. To counterbalance the impairment of aluminum there is no necessity to consider the effect of salts that may reduce or increase such impairment; the best means of resistance is reasonable treatment with from time to time a thorough cleansing with "finest solution of soda" or in the worst case with concentrated nitric acid. In a later treatise he concludes, in agreement with G. Lebbin, that even when for weeks in contact with water, under access of air or with air excluded, aluminum shows no alterations. The white spots caused by water from the Berlin waterworks both authors attribute to the presence of silicic acid in conjunction with other mineral ingredients of the water. Even more favorable results were obtained by Ohlmueller and Heise, "Investigations Concerning the Applicability of Aluminum for the Manufacture of Eating, Drinking, and Cooking Utensils." They undertook their experiments by order of the Imperial Health Office, and for the purpose availed themselves of two kinds of aluminum; one kind contained about 0.05 per cent. crystallized silica, 0.4 per cent. silica in combination, and 0.3 per cent. iron, while in the other kind 1.2 per cent. of crystallized silica, 0.6 per cent. silica in combination, and 0.3 per cent. iron were contained. The articles experimented with (aluminum plate, aluminum canteens, and rolled raw material) were subjected to the action of the fluids mentioned for two, four, or six days respectively; besides independent cooking and shaking experiments were made. Distilled water was found to exert no influence whatsoever on aluminum, whether allowed to stand or whether cooked or shaken. On the other hand, with water from the waterworks, after twenty-four hours a noticeable loss of weight was registered; moreover, peculiar excrescences of partly white, partly brown color were seen. One per cent. acetic acid reacts, when standing, slowly; when boiled, more energetically on aluminum.

while 2 per cent. tartaric and citric acid had very little or almost no effect on aluminum. Nevertheless aluminum was considerably affected by a 2 per cent. solution of table salt after protracted action, while half an hour's boiling dissolved but little aluminum.

As is shown by these experiments, the effects of acids on aluminum were the opposite of those of alkalies, as boiling in acid accelerated the dissolution noticeably, while the influence at ordinary temperature was insignificant. Coffee, red wine, and lemonade, even after protracted action, were almost without effect upon aluminum. Exposed to the influence of cognac and spirits, excrescences could be noticed upon the aluminum. Of especial vehemence was the action on aluminum of a mixture of 2 per cent. table salt and 1 per cent. acetic acid. Likewise the fact demonstrated by other experimenters is of importance, viz, that the layer of oxid on the surface caused by contact with fluids, as for instance saliva, etc., affords protection against further destruction. The experiments by Ohlmueller and Heise concerning the action of aluminum on the animal organism lead to the conclusion that this metal, especially when taken in small doses, cannot exert any noxious influence on the organism.

In the work mentioned above, the following conclusions are arrived at:

(1) Aluminum for eating, drinking, and cooking utensils is affected, within the time in general to be considered, by acid as well as by alkaline fluids, and by solutions of salt, and this at the ordinary temperature of the room, but in a relatively low degree. At boiling heat the solubility varies and in some cases attains a remarkable extent.

(2) The corrosibility of the utensils often decreases owing to changes upon the surface of the metal.

(3) The cleansing process, according to the method used, entails necessarily a relatively important loss of the metal.

(4) An impairment of health due to food and beverages which have been cooked or preserved in aluminum vessels, is not to be expected under the conditions generally obtaining.

Extended and exact investigations concerning the suitability of aluminum were also pursued by Koehler ("Das Aluminum"). In his experiments the following substances were taken into account, viz, crown glass, ordinary glass, copper, brass, zinc, lead, and aluminum bronze—the last containing 5 per cent., 8 per cent., 10 per cent., and 12 per cent. of aluminum—tin, iron, and pure aluminum.

For each of these experiments, strips about 10 cm. long, 1 cm. broad, and of different thickness were taken; for the aluminum bronze the length was 5 cm. Each strip of the aluminum—of which in every case four strips were used, of 2 mm., 5 mm., 6.5 mm., and 10 mm. thickness, while of the other metals only one strip was used—each strip was first thoroughly cleansed, and after being dried in the exsiccator was weighed and then exposed in a flask to the dissolving properties of the fluids mentioned, as a rule, for 150 hours. For this purpose the quantity of fluid was approximately proportional to the surface of each strip.

The fluid having acted on them for a sufficient length of time, the strips were taken out of the fluid, cleaned with distilled water and alcohol with a chamois rag, dried in the exsiccator, and then weighed again. The loss of weight was then recorded, taking into account the different specific gravities.

In coffee, for instance, on 100 square centimeters surface, in 150 hours, were dissolved of ordinary glass, 0 mgm.; of crown glass, 0 mgm.; of copper, 0 mgm.; brass, 3 mgm.; zinc, 6.6 mgm.; lead, 19.459 mgm.; of 5 per cent. aluminum bronze, 6.5 mgm.; 8 per cent., 4.0 mgm.; 10 per cent., 5 mgm.; 12 per cent., 3.26 mgm.; of tin, 0.7 mgm.; galvanized iron, 0 mgm.; aluminum, 0.578 mgm. or 0.214 cmm.

Crown glass, ordinary glass, galvanized iron, and tin, in this case, comport themselves better than aluminum, while the other metals were generally characterized by far greater losses.

As for tea, the corresponding series of losses aluminum underwent, is as follows—in mgm.: 8 per cent. and 12 per cent. aluminum bronze, 0; galvanized iron, 0.5; aluminum, 1; crown glass, 2.2; ordinary glass, 4.6; tin, 4.9; 10 per cent. aluminum bronze, 5; brass, 5.6—after cleaning, 12.6; lead, 19.2; zinc, 17.3—after cleaning, 44.3.

To gain an exact insight into the experiments made by Koehler, I have verified a portion of his experiments and have also worked independently of them.

Aluminum bronze—of 5 per cent., 10 per cent., and 12 per cent.—iron, lead, and copper I exposed consecutively and in strips of equal size, for 100 hours, to the action of the same quantity of Pilsener beer, Münchener beer, lager beer, Berlin light beer, and Graezer beer. The result was that, except for the Berlin light beer, the loss of weight suffered by aluminum was far less than the loss sustained by other metals, and in general was insignificant. I pursued similar experiments with 2 per cent., 5 per cent., 10 per cent., and a saturated solution of table salt. Here aluminum occupied the most unfavorable position; consider also the slow action, standing in solutions of salt, or when boiled.

On the other hand, for red wine and white wine, under equal conditions, the behavior of aluminum was very favorable.

It is very difficult indeed to answer the question incidentally alluded to, viz: To what extent is aluminum affected by water? A series of experiments in my opinion confirms the view of Plegge and Lebbin to the effect that it is silicic acid and other mineral ingredients of the water which affect aluminum, but that the intensity of such corrosion—which is of special importance—is by no means exclusively dependent upon such acid, and no more upon its suitable proportion; on the contrary, for the determination of the extent of such corrosion the salts dissolved in the water co-operate, and probably also organic matter. Some ingredients retard corrosion, others promote it; with every change of the proportion of weight the action of the different factors is modified to such an extent that a calculation of the degree of corrosion of the aluminum is next to impossible.

It hardly needs to be mentioned that the water of different water systems shows likewise different action on aluminum.

Since air and free carbonic acid—the gases kept separately—produced no solution of aluminum, I caused air and free carbonic acid in combination to act on aluminum, but could not detect the slightest trace of solubility of aluminum. I made one experiment strictly observing the conditions as they prevail in a water-distributing system. The difference of pressure in the water system and in the open aluminum tube is, according to my experience, without importance.

I employed Mannsmann's aluminum tubes of such thickness that a rubber hose could be conveniently drawn over them. The closing after the filling I did by means of a stopcock. A kind of water from one system, of the Erzgebirge, that affects aluminum, filled into such a tube, furnished in six hours a corrosion of the aluminum amounting to 18 mgm. of dissolved aluminum per hour, constantly about 3 mgm. aluminum per liter. Water from another system, even after standing for some time in aluminum tubes, showed only an infinitesimal corrosion. Further, with an artificially produced composition of 100 mgm. of free carbonic acid and continued induction of oxygen, this water remained without effect on aluminum. Likewise an addition of hydrogen dioxid with 30 mgm. of available oxygen per liter, and notwithstanding the 100 mgm. of carbonic acid previously incorporated, did not cause any corrosion of the aluminum. The hardness of the water was about 4 per cent.

While experimenting with this water no appreciable corrosion of the aluminum could be obtained by means of increasing the amount of carbonic acid and oxygen; the water from the conduit of the Erzgebirge affected aluminum even after being evaporated to one-third of its volume. That, for the conduit water of the Erzgebirge, the effect of the chlorids and sulfates which were contained in the same, although in small quantities, are the factors in question, was proved by various experiments. Nitrates were not involved, inasmuch as for the corrosion ammonia salts were not at all present.

The further experiments I instituted consisted of laying Mannsmann's aluminum tubes in conduit water of 12°, 20°, and 50° C. respectively and determining the loss of weight in twenty-four hours. While with the water of 12° and 20° about 60 mgm. to 70 mgm. of aluminum were found dissolved, the effect of the water at 50° was far in excess of this, moreover the surface of the aluminum was considerably corroded. The excretions consisted mostly of silicic acid and alumina in the proportion of 3:7.

The following experiment was interesting: A complete aluminum upper set of teeth which had been carried in a rather uncleanly mouth for two years was exposed for twenty-four hours to the same conduit water at 50° C. The result was surprising. The surface of the aluminum exhibited only insignificant traces of alteration; on the other hand, a brand-new plate, likewise consisting of pure aluminum, which had been exposed to the same conduit water during the same time, showed a considerably corroded surface. These experiments, which require but little time, prove that the corrosibility of the dental plates decreases in consequence of alterations upon the surface of the metal. Neither distilled water that is free from air nor distilled water that contains air and carbonic acid affect aluminum. Aluminum does not oxidize in dry air, but when the surfaces of aluminum are moist an abundant oxidation sets in. Moisture acts on aluminum in the same manner as on iron, viz, as a conductor of oxygen.

Aluminum suffered no alteration from carbonic acid—not even oxidized aluminum.

The less the percentage of silicic acid in the water, the less the solubility of aluminum; additions of silicic acid increased the solubility to a considerable extent. Minute additions of soda, sodium sulfites, calcareous spar, and table salt effected only an insignificant increase

of solubility, while greater quantities accelerated the solubility considerably.

The results I obtained admit of the conclusion that in the different conduit waters different acids are present, and that these are of different effect on aluminum. But an appreciable corrosion of aluminum occurs only from silicic acid in the water, though the salts dissolved in the water—and, above all, chlorids and sulfates—increase the solubility of the metal.

And now I come to the second part of my work, the question of the applicability of aluminum in dental practice.

ALUMINUM IN DENTAL PRACTICE.

The first application of aluminum for dental plates took place at the end of the sixties—and, it must be admitted, with poor success. A general use of aluminum in dentistry appeared to be out of the question on account of the low resistance of the metal to the destructive influence of the fluids in the buccal cavity. The aluminum produced in those times had the harmful admixture of iron and silica in larger quantities, and the unfavorable results of the experiments which were instituted are to be attributed to this state of affairs.

Indeed, it was these discouraging results which were brought forward as against the introduction of aluminum for dental purposes. The well-known dentists Bean of Baltimore and Sauer of Berlin, it may be mentioned, again made tentative experiments with a view to the application of aluminum for dental purposes, but also with only partial success. Each worked according to his own method of casting; for which process they availed themselves of self-constructed molds. The procedure of Bean was rather complicated and was handicapped by the following defect, viz, that only the plate was cast, while the teeth had to be soldered on later. Such plates were soon decomposed in consequence of galvanic currents which are due to the contact of the aluminum with another metal. On account of this factor the experiences with this metal obtained at that time in America were unfavorable. The procedure of Sauer, however, possessed greater simplicity and perfection. He was the first experimenter to cast under pressure by surmounting the molding pieces of the plate with a column of aluminum as a molding head. Sauer also cast the plate directly in union with the teeth, in this manner avoiding the soldering. Various reports concerning the unsatisfactory results obtained with aluminum plates created in Germany a generally unfavorable opinion concerning the value of aluminum. After the seventies a more or less lively exchange of opinions concerning the value of the new material took place, and the advantages and disadvantages of aluminum were ventilated. The result was still unfavorable, however, for the new material. Considering the responsibility of the dentist, there is no ground for surprise that after these results there prevailed a certain hesitancy to employ aluminum any longer in practice, especially since the effects of aluminum salts on the organism were not known.

The necessity of doing the casting under pressure led Dr. Carroll of New York to the idea of melting the aluminum in a crucible with a perforated bottom and forcing the molten metal by means of air pressure through the perforations into the mold. With the cast plates produced under such pressure, partly favorable results were obtained.

It would lead too far should I attempt to mention all the men who, following their conviction concerning the superiority of the new material, have spared no pains to introduce aluminum cast plates in the practice of dentistry, nor do I intend to mention all methods of casting and molding which in part are modifications and in part new methods.

The origin of the combination method of aluminum and rubber reaches back to the sixties; but only a very slow, almost imperceptible, progress of this procedure can be recorded up to this time. It was Sucrsen of Berlin who made the first practical experiments with a combination of aluminum and vulcanized rubber and in this manner built up the foundation for further development of the aluminum technique. What, we may ask, is the explanation of the heretofore underrated importance of aluminum for dental purposes? The explanation is contained in the fact that we were satisfied with results obtained by clinical observation, and did not care to gain a further knowledge by experiments aiming at ascertaining the causes of the corrosibility of aluminum in the buccal cavity. At intervals a very lively ventilation of opinions took place in the professional papers and conventions of dentists, but nothing new was evolved.

After a perusal of the literature at hand treating of this subject, in almost all the different treatises I have failed to find that strictly scientific methods have been followed. The authors in question confine themselves to stating the fact—in most of the cases assumed from other sources—that aluminum in the mouth is subject to corrosion—and venture all kinds of assertions why this is so and could not be otherwise; but there is a palpable lack of exact experimental investigations, of statistical material, or anything else of convincing power. One writer tried to find, and really found, the cause for the corrosibility of the aluminum in the overheating of the metal; another attributed the responsibility for this fact to acids contained in the buccal cavity; another finally held the alkalies responsible for the low power of resistance of aluminum in the mouth. Only with a few—for instance, Sauer—did I find experiments which I could consider as reliable. But Sauer was induced by unfavorable results in practice to desist from comprehensive investigations concerning the aluminum-destroying properties of the fluids in the buccal cavity, and to occupy himself more with aluminum bronze.

Allow me to again call attention to the rule that we should not give opinions based on theories that are not proved. Scientific problems—when aiming at practical results—must be investigated exactly; for new facts that can only be proved by sufficiently methodical experiments—in our age, so prominently given to the study of the natural sciences—are not to be demonstrated by recourse to preconceived theoretical leanings, even when brought forward with strictly logical acumen.

From this—I believe inevitable—digression I now revert to my experiences and the methods I employ in treating aluminum.

Personally I have employed aluminum in practice since 1893, and never have had to register lack of success that could have thrown discredit upon this material. Lack of success I have seen in my practice only when I had made use of aluminum where it was not suitable on account of the "bite," or with partial plates, and above all with single-tooth plates, where

the aluminum tongue that has to bear the tooth or teeth proves to be too feeble a support for the rubber. The cases of poor success which other practitioners have reported, where, with the employment of complete plates, the plate, it is said, showed corrosion after it had been in the mouth only a few days, I attribute to the inferior composition of the aluminum and to the lack of adequate knowledge of the aluminum technique. In the mouth—as is generally understood—only pure aluminum should be used. Aluminum, in my opinion, will never displace gold in dentistry, any more than it will supplant iron in other industries; it is sufficient that it helps to limit the use of caoutchouc, which in many cases is destructive both to the teeth and the gums. To every dentist the disadvantages to which caoutchouc in most of the cases subjects the bearer are familiar; for this reason I may dispense with a discussion of that phase of the subject.

The special merits of aluminum are its extraordinary lightness, its slight metallic luster, its indifference to the action of the mucous membrane in the mouth, its remarkable susceptibility of polish, easy method of working, resistance against oxidation, and superior capability of adhesion. But it is only pure aluminum in which the power of resistance to the acids in the mouth is so satisfactory; aluminum with a more or less strong admixture of silica and iron is in the long run subject to electrolytic as well as chemical decomposition. The dentist must be on his guard not to employ too soft an aluminum, but only the so-called hard aluminum, which nevertheless possesses a sufficient degree of elasticity, and notwithstanding which it is not easily spoilt by bending. By a too strong heating aluminum loses its elasticity, therefore it should be heated at the utmost to a red heat of low degree, and should be always allowed to cool slowly. Otherwise, instead of its merits, aluminum will exhibit a multitude of demerits, as by overheating, as well as by too rapid cooling, it becomes soft and brittle and often breaks. All impurities adhering to the aluminum after rolling or stamping should be carefully removed, otherwise they will afford favorable points for corrosion by all kinds of chemical reagents.

The thickness of the plate never should be below 0.7 mm., and even then should be used only for complete adhesion plates, as thin partial plates are easily bent. In the last-mentioned case the plate should without fail be 1 mm. thick. Only the careful practitioner will be able to treat aluminum with success, since only an aluminum plate executed without a flaw from start to finish, and where all possible eventualities have received due consideration, will satisfy both the dentist and the patient.

Unfortunately, we have in aluminum technique a variety of methods for attaching the caoutchouc which are enough to discourage the beginner. All of these systems I have submitted to a close examination, and I consider only a few of them worthy of imitation. At present I work exclusively in pursuance of a procedure in which, by the picking out of barbed hooks on the plate, the teeth are fastened by means of caoutchouc. Many are the sins of practitioners in the point of fastenings, some of them perforating the aluminum from all corners and angles. They seem to place the principal value in as many fastenings as possible, lest the caoutchouc jump off from the aluminum; thus they do not appreciate the fact that the base-plate—in this case

the aluminum—during mastication has to withstand the greatest resistance, and therefore should not be weakened immoderately. Further, many dentists do not consider the fact that aluminum in the mouth, brought in contact with other metals, will cause electric currents. To avoid this and obviate the decomposition of the aluminum, we must be on our guard not to lay the tooth-pins, gold braces, or wire fillings on the aluminum, but on the contrary to imbed them carefully in the caoutchouc. The caoutchouc layer, in point of fact, may be very thin, and with some practice a complete isolation of the aluminum be secured. For the preparation of partial plates a double measure of precaution is advisable, especially when single teeth are to be replaced and where the aluminum tongue serving the purpose of attachment, that passes between natural teeth, is necessarily narrow. In such cases, wherever a replacement in aluminum is insisted upon we should at least apply the fastenings not only to the metal tongue, but also to the aluminum strengtheners that include the adjoining teeth, in the manner of a clamp.

Without qualification, I find the employment of aluminum ideal for complete adhesion plates. Here we may, as I mentioned above, use thinner plate than for partial pieces, since the danger of spoiling the plate by bending hardly exists in the case of complete upper plates. For complete plates of the mandible it is well to use plate 1 mm. thick. It is worthy of special attention that for the lower teeth, above all where molars and premolars are to be replaced and the front teeth are still extant, the entire aluminum plate should upon the exterior side be covered with caoutchouc to obviate the bending of the plate. Other dentists prefer in such cases double stamped plates which must be riveted carefully; personally, I prefer the first-mentioned method.

As to the preparation of aluminum plates I observe the following mode of procedure: Having taken a plaster-of-Paris impression, I make therefrom a Spence metal cast, as I prefer one of that material to one of plaster of Paris, for it cannot be damaged by the manipulation incident to the adaptation of the plate, adjustment of the clasps, etc. If greater sections of aluminum work are to be executed, or complete upper plates, first of all I obtain information concerning the condition of the palate, especially whether the mucous membrane of the hard palate at the place where the aluminum plate should end, to the side of the palatal suture, be soft; further whether there exist raised hard places on the palate. Such areas are often found in the center of the hard palate at the juncture of the two palate bones. Raised hard places in the palate I cause to lie hollow by scraping round these places in the impression; the effect is the same as from a vacuum chamber. Moreover, in cases of abnormally soft mucous membrane of the palate, I am in the habit of scraping sideward to the suture of the palate for the purpose of effecting thorough adhesion of the plate at this place.

Since for aluminum work, as generally for metal work, several casts are required, it is well to obtain a duplicate of the cast made from the original impression. With a mass of modeling composition an impression is secured of the Spence metal cast from which may be obtained at any time an additional one. And it is absolutely necessary that the metal plate with teeth be finished only on a model upon which the plate every-

where fits well, a circumstance of the highest importance for articulation. Taking into account the scraping of hard places, of vacuum chambers, of the posterior margin of the palate, it is clear that good articulation can be secured only when from the beginning of the work a definite model is employed. Often it is advisable to take an impression with the molded plate in the mouth—as, for instance, where long teeth projecting far into the mouth or strongly recurved, and especially loosened teeth, are present. In this case, where mostly we have to be content with an unsatisfactory Stents-impression—as otherwise, taking an impression on plaster of Paris, there would be the danger that the latter could only be obtained by sacrificing the loosened teeth—it is certainly advisable that we convince ourselves of the good fit of the plate in the mouth, by fitting-in the same and taking an "impression" before finishing the plate.

Being satisfied that the mold has turned out well, we undertake the swaging of the plate. For the purpose of exactly measuring the size of the plate to be prepared, we have to mold a piece of lead or tinfoil cut according to the size, and after reducing the molded foil by clipping we fit the same to the aluminum plate. In this case we do well to take the size of the plate a little larger. Now we fit the plate superficially to the impression, to avoid bending while pressing the same. Before proceeding with the first pressing, the plate is to be thoroughly heated and then cooled slowly, to render the aluminum softer and more flexible. In heating the aluminum we have, on the other hand, to avoid overheating; brittleness and loss of the already low elasticity would be the consequence of such oversight. Haskell, for instance, heats the metal until a match placed thereupon begins to char. Likewise we should employ all possible precaution to prevent too sudden cooling. Further, it is advisable to oil the mold well; this facilitates the pressing.

The first time we should press only lightly—namely, in such a manner that the impression of the teeth is marked on the plate. Hereupon we open the flask, clip off the superfluous part of the plate and then press again. Having convinced ourselves once more of the proper position of the plate, we press with more energy for the purpose of finishing the plate under gradual increase of pressure. A firm and equable sitting of the plate without the slightest rocking results after it has been molded to a finish, so that when taken to the model which serves for further elaboration the plate will fit the latter perfectly. As for the pressing, it is well to proceed carefully, and especially so in cases of highly arched palates with recurving places. Here the aluminum would undoubtedly tear should we start at once to press with considerably energy. Furthermore, the mold would suffer too much without sufficient preparatory pressing of the plate, and we should have to resort to the casting of a second, and may be of a third mold. Therefore, to avoid unnecessary work with high palates, we may proceed in the following manner: After preparatory stamping of the plate we remove it and fill the space yet left between the aluminum and the palate with lead or tinfoil, putting over the palate some rubber dam, and then gradually finish the pressing; then follows the fitting in the mouth and "bite-taking" with the plate. Recurving places at the alveolar margin, finally, are rectified on the model, using a wooden or horn hammer.

In fitting-in the plate we devote special attention to small depressions, and see that the plate after energetic pressing sits firmly, does not "ride," a fault that may be due to the remaining teeth or to roots not sufficiently cut down. The plate, after pressing on, must show everywhere equable adhesion. If this be the case, we take a "bite" with the aluminum plate, then set up the teeth, in exactly the same manner as for vulcanite.

Considering the last-named to be a thoroughly familiar manipulation, I merely mention it, and advert to the fastening of the caoutchouc on the aluminum. There are various methods employed for these fastenings and I shall try to give a short description of them, leaving it to the judgment of each member of the profession to form conclusions concerning the merits and demerits of the different methods.

As for the methods of fastening with caoutchouc, we have to note that the junction between aluminum and caoutchouc can be only mechanical, and must therefore be firm and durable. It is possible to secure with the caoutchouc attachment a very exact articulation, and there is no danger of dislodgment of the plate, as is the case when resorting to soldering—two very decided advantages compared to soldered plates. The production of the means of attachment is of course different from that used for gold or plates, where they consist of tacks riveted on, wires, springs, etc. In the case of aluminum we arrive at the same results by means of barbed hooks picked out by a graver, by roughening the plate, by the riveting of tacks, by bending off and then perforating the plate, etc.

I pursue the following method: After carefully boiling out the wax, I define along the edge of the maxilla a groove toward the inner side of the palate, somewhat depressed; in this manner I obtain an excellent fitting of the caoutchouc. Then, using the same graver, I pick out small barbed hooks in every direction, and finally I roughen the aluminum along the channel mentioned above. This method I have employed for many years, and may recommend its adoption. One precaution is urgently required, viz, to set the plate on the cast when applying the fastenings, thus obviating the bending of the plate. For lower plates, which are even more liable to bend, it may be recommended to cast within the plate a model of plaster of Paris, and to take off the plate only after the places of adhesion have been provided for. Thus stability of the plate is secured. An aluminum set produced in pursuance of this method will give full satisfaction, especially as the palatal surface of the aluminum will remain perfectly free from caoutchouc. Of other methods, one which has met with much approval is that in which the caoutchouc is fastened with riveted aluminum wire tacks which are driven through from the palate side of the plate. Beforehand, the places are to be defined exactly where the tacks are to be riveted; moreover, we must see to it that the tacks be not in the way of an artificial tooth or the pins of the same. It is best to press through the respective places a little by means of a triangular scraper, using a model of plaster of Paris as the basis of the plate, so that the said places will appear on the palate side as small eminences.

Now the plate is to be laid upon the counter mold in such manner that the palate side of the plate will lie above; then, with a drill corresponding as far as possible to the thickness of the wire tacks to be used, vertical holes are to be drilled

through the plate and the mold, corresponding as nearly as possible to the length of the tacks. These tacks are then driven into the drill-holes by means of a small hammer and punch, whereupon they are carefully riveted to the palate side. Then the plate is to be pressed again. To facilitate the separation of the plate—which literally is nailed on—parallel direction is given to the drill channels.

But the reliability of this manner of fastening leaves much to be desired; the result, it must be conceded, is by no means in proportion to the care bestowed upon the work. Moreover, for instance with partial plates, the plate is weakened to a considerable extent by the tacks which are riveted-in in couples. The method of using screws, therefore, stands in higher favor.

Having taken an impression with the plate in the mouth, after casting the plaster-of-Paris cast, the places are to be defined, using a triangular scraper, where one intends to supply screw threads in the aluminum. With a tap that corresponds to the aluminum wire screws to be used, first of all the thread is cut into the plate; the wire screw is then moistened with oil and screwed on from the palate side. But of this method I likewise have no high opinion, for two reasons: in the first place the aluminum plate cannot be made thick enough to offer to the screw a sufficient hold; then, again, aluminum is too soft for this method of fastening.

An excellently strong junction between aluminum and caoutchouc is obtained by covering that part of the aluminum bearing the fastenings, before filling in the caoutchouc, with caoutchouc that has been dissolved in chloroform or benzine and allowing it to dry thoroughly. May I again emphasize that before filling in, a junction absolutely free from dirt or oil must be effected for the caoutchouc, as otherwise an intimate adhesion of caoutchouc and aluminum will not take place. All the wax must be carefully boiled out with hot water and then thoroughly washed out with benzine; only with the use of this precaution will the rubber permanently adhere to the aluminum.

The covering of the plate with plaster of Paris is executed in almost the same manner as for caoutchouc, with only the slight difference that the aluminum plate is covered with plaster of Paris up to the wax.

The filling-in is to be done in the usual well-known manner, only that after the filling subsequent heating should be avoided, as aluminum by itself, owing to its high specific heat, retains the absorbed heat for a long time.

The vulcanizing done, the caoutchouc covering is worked out in the usual manner. Finally any rough places are polished with pumice-stone, and then after thoroughly washing and drying the plate it is polished over again with chalk. But, *De gustibus non est disputandum.* One person prefers bright, another dull polishing. The latter may be secured by boiling the plate a short time in a solution of soda; but, considering that soda is one of the most dangerous destroyers of aluminum, the metal should be brushed thoroughly several times after the boiling. The aluminum after this treatment shows a beautiful dull white surface. Nevertheless I cannot refrain from warning against this procedure of maceration. In addition to the fact that with the influence of soda, caustic soda, and other alkalies there follows a loss of substance which is not to be underrated,

we must in this case recognize the fact that the macerated plate will be from both sides subjected to the alkaline saliva and organic acids, such as acetic and lactic acid as well as others; this, in time, will result in a considerable loss of substance of the aluminum. A further inconvenience is that caoutchouc is strongly affected by hot acids and alkalies, and that, above all, coloring matter is dissolved which will discolor the caoutchouc. Besides this, the firm junction between caoutchouc and aluminum would probably suffer.

Where dull-colored plates are absolutely insisted upon, it is advisable to do the maceration before vulcanizing. To remove the oil used for polishing, it is then best to use benzine and soap and water.

A special obstacle to the application of aluminum consisted for a long time in the fact that the metal could not be soldered. Indeed, different methods of soldering were invented, and the "Société d'Encouragement," etc., once paid to Mons. Mourey a premium of 200,000 fr. for a method to solder aluminum invented by him. But so far no procedure of soldering has covered the requirements. Later on, practitioners tried the expedient of soldering copper-plated aluminum (which can be worked like copper plate and also soldered) and then dissolving the copper in nitric acid. But this procedure, likewise, did not enjoy any long duration.

Whether in the future a method of soldering aluminum will be discovered or not, may nowadays be considered as a matter of indifference to the profession, since we possess in the aluminum-caoutchouc plates a substitute, one better than which we could not desire. Therefore let us energetically combat the old prejudice still surviving with many dentists against the practical application of aluminum. Though some time ago aluminum was not able to resist the fluids in the buccal cavity, and as a consequence the metal often after short use was perforated like a sieve, now we know the cause of the trouble; and we know that pure aluminum properly treated, using all necessary precautions, will do excellent service in the buccal cavity. Furthermore, we know that the corrosibility of aluminum plates due to changes on the surface of the metal decreases continually. This alteration consists of a brown membrane-like covering which appears after a short time on the surface of the aluminum, especially in mouths that are not kept very clean.

These statements, I hope, will be sufficient to prove that theory and practice, the results of scientific investigations as well as the experiences of the technical practitioner, may encourage the dentist to apply aluminum in the buccal cavity unhesitatingly.

The CHAIRMAN. This concludes the program of the Section on Chemistry, and there being no further business before the section, it now adjourns *sine die*.

Fourth International Dental Congress.

SECTION IV.

SECTION IV:

Oral Hygiene, Prophylaxis, Materia Medica and Therapeutics, and Electro-Therapeutics.

Chairman—Dr. A. H. PECK, Chicago, Ill.
Secretary—Dr. J. G. REID, Chicago, Ill.

FIRST DAY—Monday, August 29th.

THE section was called to order on Monday, August 29, 1904, at 2.30 P.M., by the chairman, Dr. A. H. Peck.

The first order of business was the reading of the Chairman's address.

Chairman's Address.

Dr. PECK, on calling the section to order, said: Gentlemen of the section, I deem it a very great honor to have been selected to preside over the deliberations of a section of this great congress, and had expected to present a paper commonly called "Address of the Chairman," but the hour is already late, and we have a large amount of work before us. While it is true that according to custom it is fitting and proper for a chairman to present an address, I have always been impressed with the idea that it is more the duty of a presiding officer to preside over the deliberations of a body than to occupy the time in speechmaking. As the papers to be read in the section treat, in an exhaustive way, of nearly all the subjects pertaining to the section work, and as Dr. Taylor is waiting to read his paper and several gentlemen are present to discuss it, we will proceed at once with the work before us.

The next order of business as announced by the chairman was the reading of a paper by Dr. C. R. TAYLOR, Streator, Ill., on "The Human Mouth and its Hygiene," as follows:

The Human Mouth and Its Hygiene.

By C. R. TAYLOR, D.D.S., Streator, Ill.

THE first forms of animal life consist of animated drops of jelly-like protoplasm; the drop moves about by being able to project any portion of the body—as with the motion of straightening a finger—and then following with the rest of its mass until it again assumes a globular form. It has no distinctive organs and seems to have only one sense, and that is the elemental sense of touch. Through that power of sensation it selects the kind of nourishment it needs, by enveloping the food and thus using any and all parts of its mass to digest and assimilate the food necessary for sustenance and growth. Having no organs, all its parts are equal, there being no division of labor by organized effort. It eats, digests, and reproduces itself without specialized organs. Nature was not content for animal life to be merely a mass of protoplasmic jelly: for in that little mass of protoplasm lie hidden all the potentialities of being, up to the intricate and refined organism—man.

All the functions of life at some stage of being imply conscious effort. When in the earliest forms of life there are no organs, digestion and assimilation are voluntary conscious acts, as is eating in the later forms. Eating and assimilating, seemingly, are all that the being knows. It seems to be simply an animated appetite. As life enlarges and special organs are formed the functions become involuntary—when in their normal state—and are performed unconsciously by the individual. As life moves forward it takes on special functions. These changed parts of the mass become organs, and as these organs and their functions increase, the forms of life become more complicated.

Among the very first organs—and one of the most important—is the digestive cavity, which at first consists of simply a cup form for the purpose of absorbing nutriment, but by degrees enlarges into mouth, esophagus, stomach, and intestines. From this primal digestive tract are evolved, as offshoots, all the organs of respiration, digestion, secretion, and excretion. Clodd, in his "Story of Creation," says: "And the important part which the mouth plays as the immediate channel between the animal and its surroundings accounts for the development of the higher organs of communication near it." The nose, eyes, and ears are associate members with the tongue to aid the mouth in the proper selection of food. In fact, the eyes, ears, and nose are most important factors in the preparation of the digestive organs for the assimilation of food even before it reaches the organs of taste. Not only is man's mouth made to water, but the mouths of the gods are said to do so when the nerves of the nose are excited by "sweet smelling savors" of food. Want of some kind unsupplied is the great incentive to life. The first and last demand of man is the necessary amount of oxygen to keep the machinery of life going; so all the senses are closely associated in position and function to apprehend and supply the wants of ani-

mal life. As the undeveloped digestive tract (alluded to above) changes under the laws of "correlation of organs," all the other organs of the body change. For instance, the demands of the digestive tract of the tiger have developed the sharp teeth and sharper claws characteristic of this savage beast. Whatever food the alimentary canal calls for, the outer organs of the body are prepared to furnish. Back of all the phenomena of life, is life itself, which has the capacity and power of being all that the circumstances will permit or force it to be. What life is no one knows; but whatever it is, it precedes form, and its possibilities of development can only be conjectured.

The use or non-use of organs may mean progress or degeneracy to the animal possessing the organs, but it always means degeneracy to the organs not used. Animals which show a disposition not to use their eyes, finally lose them; and creatures which develop a desire to fly have wings given them. The *Balæna mysticetus* whale changed its mode of living and took to the water; nature gave it sifting baleens and took away its teeth. The whale became an oil-tank.

The owl evinced a disposition to eat things that live in dark places, so nature gave it big eyes, a sharp beak and claws, and soft feathers—all members of a description to help it in its predilected mode of existence. And as for the Cestoid, whose requirements of life were very modest, nature gave it a head without brains, just hooks and suckers to attach itself to its host, and it became a tape-worm, floating in its food, with power to absorb its nourishment through the body.

To the paleontologist a knowledge of the organs of mastication explains the anatomy and habits of the animal to which the organs belong. It is through the mouth—and by mouth is meant the power to select and assimilate the kind of food the creature prefers—that all changes of anatomical forms have largely come, because of the fact that the kind of food selected has been the primary factor in making the forms that life assumes. The dental organs tell the story of the past, the present, and—to a large extent—the future habits of the animal. The physical and climatic environments are important factors in life forms, because they produce the food to be selected; but when once the food is selected the character of life to be developed is determined.

So far as we know, man is the masterpiece of life's production, and of all his features his mouth is the most expressive and characteristic. The mouth performs many functions beside those of mastication and insalivation of the food. Primitive man often used his jaws and teeth as weapons of offense and defense, and modern man frequently makes his mouth supply the place of a third hand when needed. All people, excepting the Japanese and a few uncivilized tribes, use either contact of the lips or regions near the mouth to convey the outward manifestation of love and affection.

The mouth is the only opening through which the body receives nourishment, triturates, and insalivates it, and thus in a rough way prepares it for further digestion. In the mouth is located the special sense of taste so closely associated with the sense of smell, and in the senses of smell and taste lies the beginning of digestion. The senses both of smell and taste aid in the nerve stimulation of the salivary glands, and their excitation starts the muscular movements of the whole alimentary canal, which in turn

causes all the glands of the tract to perform their duties as the food manifests its presence in their locality. In the mouth reigns supreme that most wonderful organ of touch, taste, and speech—the tongue. Out of this vestibule of the body—the mouth—comes the melody of sounds, of song and laughter; through it the gift of speech makes itself known and enriches life, and by it the divine intellect gives its commands. By its use the orator moves the hearts of his hearers, and through it man communes with his gods. Emerson says, "If the tongue had not been framed for articulation, man would still be a beast in the forest." Poets have sung of pearly teeth and cherry lips, and the beautiful curves of "Cupid's bow" have been admired and drawn by the greatest artists.

A critical knowledge and a clear discernment of the outer and inner parts of the mouth, and their relations to each other, are of utmost importanee to the dentist. This is particularly so in the arrangement and adaptation of artificial substitutes for natural teeth, and the adjustment of teeth in position when regulation of the natural teeth is required. That the peculiar relations of the lips to the parts of the oral cavity make difficulties hard to overcome is well known to those who make artificial dentures. What is more trying than a prominent alveolar ridge and a short lip with a raised corner? No part of the face has more to do with its expression than the mouth. This is due to the muscular arrangement and mobility of the external parts.

All the emotions of the soul, intellect, and body find means of expression at the mouth and adjacent parts. Anger, joy, grief, vexation, exultation, and contempt cloud or illuminate the features at this portal of the face. In some persons the upper lip has no range of expression in speaking; it simply hangs in position, like a leather curtain,—and yet when it is imperfect in form, as in hare-lip, the whole face and features are badly marred. The expression of the mouth often gives a clue to the mental and spiritual qualities of the individual. In the form of the mouth and the set of the lips and lower jaw is often revealed the motive force of the individual. No matter how intellectual or moral he may be, if he possess a weak mouth and retreating chin he will fail for lack of forceful expression, though he be in reality a genius or a saint.

In the ages of evolution, the mouth and teeth have been important factors in the struggle for development, calling forth energy, endurance, and courage. How often patients say, "If I could but shut my teeth together, I eould endure the pain more readily." The form, size, and arrangement of the teeth and jaws should indicate the kind and form of the many operations in our profession. The mouth is of speeial interest to the dentist, and yet how few of us know all we should of it in health and disease? It has many vital and varied stories to tell to him who is wise enough to see and interpret them. How many notice in detail the variations from health to disease in the various soft and hard parts of the mouth? And yet there is no portion of the body that so plainly shows forth the state of health as does the oral eavity. To the learned and discriminating diagnostician the mouth betrays the secrets of insidious diseases of local and systemic character. The color, weight, and other characteristics of the seeretions and the shades of eolor and peculiar physical expressions of the mucous mem-

brane and the odors arising therefrom, are frequently infallible guides in diagnosis. Drs. Michaels of Paris and Kirk of Philadelphia are teaching the profession how to discern the state of the whole body by a perfect knowledge of the conditions manifesting themselves in the mouth through the saliva. Such a knowledge and wisdom of discernment is most important to the practitioner if he is to fulfill his mission to his patients.

The conformation of the head has much to do with the general form of the alveolar arch and arrangement of the teeth. Persons having long and narrow heads have correspondingly long, narrow-arched mouths, while persons having round or square-shaped heads usually have alveolar arches conforming somewhat in shape to the contour of the head. In Europe there are at least three well-defined types of racial heads and dental arches, namely, the Baltic (called the Teutonic), the Alpine, and the Mediterranean. In this country these European races are so thoroughly intermarried with other races that typical cranial conformations have lost their original form, resulting in a conglomeration of small teeth in large jaws, large teeth in small, contracted arches, with disastrous malformations and degenerate tendencies in the teeth, alveolar processes, and jaws. This diversity in the form of the head and features should be a matter of great concern and study by those who make artificial substitutes for the natural teeth; for a full knowledge of these facts combined with the requisite technical skill would prevent a great many of the hideous mistakes we constantly see grinning at us in the mouths of persons who patronize dentists who use the same mold of teeth for all kinds of people, and arrange them on the same general contour. Let us get away from the idea that there is any divine ideal in the human mouth, and study each mouth as it is or should be to conform to the features of the individual seeking our services. The form of the head and general features of patients seeking the correction of irregularities of the teeth should be studied carefully by the orthodontist, so that the rearranging of the teeth may conform to the natural cranial and facial conformations of the individual. Whatever a race of people eats, does, and thinks is reflected in the shape of the head, mouth, and features, and if taken in hand in early life these parts may be modified in the individual.

Few realize that the final results of mastication are not fully attained by the comminution and insalivation of the food. Important as these processes may be, there is another very important function performed by these acts, namely, the development of the organs of mastication and their continued good health, brought about by their full use. Herbert Spencer says, in "Principles of Biology," vol. i, page 161, "In the higher animals, however, the performance of the alimentary functions depends on the performance of various muscular and nervous functions. Mastication and swallowing are nervo-muscular acts; the rhythmic contractions of the stomach and allied vermicular motions of the intestines result from the stimulation of certain muscular coats by the nerve fibers distributed through them; the secretion of the several digestive fluids by their respective glands is due to nervous excitation of them; and digestion, besides requiring these special aids, is not properly performed in the absence of a continuous discharge of energy from the great nerve centers."

May it not be possible that herein lies the source of so many cases of faulty metabolism among civilized men? The differentiation and specialization of the alimentary canal in man is so complete that any imperfection in the action of digestion in one part makes it difficult if not impossible for the other parts to complete what should have been done in the region at fault. As an illustration, the imperfect trituration and mixing of the food with saliva in the mouth leaves the stomach unable to complete the process of digestion. In the lowest forms of life any part of the body is capable of performing any function the organism requires, but in man few, if any, organs can perfectly and completely perform the functions of another. The result is that the most disastrous consequences follow the hasty and imperfect use of the mouth in the initial and most important part of digestion.

Too much empiricism is indulged in by indicating the kind of food one should eat, when the fact is that man has always found his accustomed food equal to his physical needs—if he could only get enough cf it. More people are dying from too much, rather than from too little, food. From the rice marshes of China to the blubber fields of the Arctic regions, nature has given man sufficient bone- and muscle-making material in his food to insure enjoyment of good health when he has performed all the duties and functions that nature requires of him.

Life's calendar registers no lottery; there are few prize packages in nature's work. She makes few continuous-gum sets at rubber prices. Vicarious atonement is very imperfectly carried on in nature's laboratory. Man's development of the pampered pug dog's dental arch shows what the present civilization is doing for man's.

Abundance means prodigality; but a temperate strenuous life bordering on want means physical perfection. Nature's fountain of life is not found in "Sunny Jim's" laboratory, nor does it stream through the glass bottle and rubber tubing of the nursing bottle. Nature seems to care very little for the individual, but she makes a supreme effort to save a race. Man has learned how to develop the domestic animals, but is not willing to pay the same price for his own perfection. The teeth and their perfection are due to the necessities of life; when the necessities cease, the teeth will pass away. There are too many millers and cooks, who do the work the teeth should do. If the human race is to retain its teeth there must be a more thorough use not only of the teeth themselves, but of the whole masticating apparatus; this means that there must be a greater amount of nervous and muscular energy put into the chewing of food. And if we are to do our duty to our kind, as professional men, the work of the future will be preventive rather than curative, and the methods pursued will of necessity be along the line of observing the natural laws of health rather than pursuing artificial means of preventing disease.

All organs are the results of cause and effect—because of the necessities of their being—and they are as perfect as necessity requires under the law of use and disuse. The laws of hygiene are the natural laws that govern the growth and conserve the health of each order of being, and when those laws are observed "health is catching," and all the organs of the body work together for good for the whole being. When for any cause an organ fails to perform the functions

for which it was prepared, disease of that organ commences and all the associated organs are abnormally affected. Most of the dental hygiene advocated and taught at the present time is simply artificial, or temporary, and the results are very imperfect. Nature makes no mummies, but does everything she can to make and conserve useful living beings. The whole earth is a graveyard of obsolete beings who failed to meet the conditions of life necessary for their continued existence, and the dental organs of man are fast becoming obsolete under the same immutable laws. Their only possible salvation is in the full use of the dental organs.

Filling and cleaning of the teeth *per se* add no perpetuating force to the teeth; such procedures simply conserve a certain person's teeth for a shorter or longer time. Nature's way is to put the teeth to work; and when the laws of nature are fully complied with the teeth need no filling or artificial cleaning, for they are as perfect as they need be to fulfill the functions of their existence. The customs of civilization are not always based upon biological laws. The range of life is confined within a very limited field. A few degrees of variation in cold or heat will annihilate all the life-germs on this earth. A complete change of food in quantity and quality materially affects certain portions of the body. Temperature and food are dominant factors in all life forms. Civilization may through man's intelligence so change the organism of man that he will need no teeth. It would seem as though his personal appearance would suffer from such a change, from an esthetic point of view. A departure from the hygienic laws of nature in the care of wild and domestic animals results in the same disastrous effects on their organs of mastication. Slop-feeding of cattle produces diseased dental organs similar to those found among civilized man, so called. The probabilities are that decay of the teeth and most all other diseases of the oral cavity can be traced to systemic difficulties rather than to local causes—outside of imperfect mastication—which accounts many times for the immunity from decay that prevails during the adult lives of most persons, with lack of immunity in early and senile life.

So the great effort should be to produce the proper hygienic conditions by a most thorough comminution of all foods, especially cooked starchy foods, before they pass the first organs of digestion—the teeth and saliva. Uncooked starchy foods are in themselves the best cleansers of the teeth during mastication. We have been told, until the saying is a trite one, that "The teeth will not decay if they are kept absolutely clean." The objection to this hypothesis is that it is impossible to keep the teeth absolutely clean. Observations and experiments show that all animals are immune from decay when they observe (consciously or unconsciously) the laws which make it necessary for them to have teeth.

This paper is not written to antagonize the artificial prophylactic movements necessary to be used to keep the teeth clean under our present food habits; but the serious question is whether or not the human race will have any teeth at all. The prophylaxis practiced and advocated by Dr. D. D. Smith of Philadelphia and others is of the utmost importance under our present culinary customs and food habits. There seem to be two ways of caring for the teeth; the first is the natural hygienic method of following and observing the natural laws of animal

economy which produce and conserve the organs of mastication, while the other method consists in simply using artificial prophylactic means of keeping the mouth and teeth clean. The second method is too superficial to answer, except as a temporary expedient; it is simply individual and transitory in its effect. The first method has a creative effect, for it not only conserves for the individual but it creates and perpetuates for the race. It not only preserves the teeth, but it keeps all of the oral tissues and organs in their normal relations, and its effect on the whole of the animal economy is systemic: its essence is vital and elemental—for it goes to the bottom of things. We lay the emphasis in the wrong place when we say, "tooth-brush, pick, floss silk, and antiseptics." What is needed is oxygen, exercise, and natural food. It is our great duty to teach man to keep his mouth clean and in good order by using it most thoroughly and strenuously in the mastication and salivation of his food.

Discussion.

Dr. D. D. Smith, Philadelphia, Pa. Dr. Taylor very kindly sent to me some time ago a copy of his paper, requesting that I would open the discussion for him. I have not had the time to devote as much attention to it as I would like, and perhaps have not sufficiently imbibed the spirit of it; but since he is a graduate of the college to which I was attached for fourteen years, and my name is on his diploma, I have a very warm feeling for him on this account, and I am sorry he has invited me to speak on this paper, because it seems to me to antagonize everything I have been teaching during the past eight or nine years. As I listened to his reading of the paper this afternoon it did not seem so harsh as it had appeared on my reading it. I regret what I have to say, because of my very kind feeling for Dr. Taylor, but I must of necessity say that which I know to be true in relation to this matter of prophylaxis. There are certain modifying sentences in the latter part of the paper, in which he speaks of my work in this line, but I think it cannot be denied that the whole spirit of the paper is antagonistic to the views which I have presented. So, of what little I have to say upon the paper I would like the stenographer to take an exact report, and allow me to have an opportunity of thoroughly revising it before it is published, because I would not under any circumstances have it come out that I am antagonistic to Dr. Taylor in the sense of being opposed to him as an individual.

We want to get at the vital fundamental truths in the discussions of our papers, and we have not reached that yet in dentistry. We must go a great deal deeper than this paper would lead us, it seems to me. That at some stage of being the function of life is conscious effort; that the eyes, ears, and nose are most important organs in the preparation of the food; that the digestive tract of the tiger gives to it its sharp teeth and claws, and that life is possible of being all that circumstances will permit it or force it to be—are statements of science which, as statements of science, seem strangely unnatural and strangely incomplete. That the use or non-use of organs may mean progress or degeneration of the animals possessing the organs, seems out of tune with the theory of evolution, upon which this whole paper seems to be based. I would say that man

has attained to the masterpiece of life through the betterment of the mental and spiritual and the disuse of the gross and sensual. The statements that the mouth performs many functions besides the preparation of food; that the mouth is the vestibule out of which comes the sweet melody of sounds—and Emerson is quoted as saying that "If the tongue had not been formed for articulation, man would still be a beast in the forest"—all these statements seem to me to indicate a strange line of observation. Do not the beasts of the forests have tongues? and does not the roar of the lion and the bleating of the sheep demonstrate to us that not only have the animals articulation but language as well? These observations seem more oratorical than practical. These are matters of trifling import to be discussed in this convention, and in comparison with certain other conditions of the mouth and teeth are passed over by dentists with a mere "of course."

The principal office of the mouth and teeth, as implied in this paper, is the assimilation and mastication of food. Now, a contradiction of this position may possibly sound strange to all my audience, and may seem revolutionary; nevertheless, neither tooth mastication nor mouth insalivation are necessary prerequisites to intestinal digestion in modern civilization. The maceration of foods in the mouth is an office which can be performed elsewhere, not only without injury but frequently with benefit. In the mastication of food in the mouth, water can be substituted for saliva without detriment, and will overcome the toxic effects of the mouth and teeth with decided advantage to the stomach and the whole digestive process. When I say saliva, I mean nothing but a mixture from the six glands which open into the mouth and not the secretions from the mucous surfaces. I am talking of saliva pure and simple, of which there is not a particle in my mouth at this minute, or in the mouths of any of you here this afternoon. There is not a particle of saliva in your mouths coming from these glands which are the source of supply for the digestive material taken into the mouth. The gentleman spoke in his paper of saliva as the material which makes starchy substances digestible, converting starch into sugar. The sublingual gland, which opens directly under the tongue and which sometimes forms a stream as you open the mouth, does no more toward converting the starchy material into sugar than does so much water. That is about all that it is. But there occurs another sort of saliva in the mouth, which is ropy. When you have a rubber dam on a lower molar and the patient is quiet and you are filling that tooth, this saliva will fall out on the side and drop down on the floor in a stream as large as a pencil. The submaxillary secretion as it comes out of the mouth will drop down on the floor in a long, ropy condition. We call that ropy saliva. It never goes into the mouth. It is a secretion which wraps around the bolus of food just as it is taken into the stomach, and that is where the change of starch into sugar commences—by the action of the ropy secretion of the submaxillary gland. Mastication of any food substance can be perfectly performed out of the mouth without the aid of the teeth. The mass is reduced to a pulp or semi-liquid, and is as ready for digestion as though prepared by the teeth. Water is an integral part of nutrition of greater importance than saliva, and it is as necessary to digestion

as to tissue replacement and the maintenance of life. I discovered this when, in my presence, a homeopathic physician told his patient that in taking milk he should chew the milk. I had never heard of such a thing. The benefit—it would be anything but a benefit in many cases, such as a filthy mouth—is derived from the fact that this special submaxillary secretion is wrapped around what we might term the bolus—the amount taken at a single act of deglutition. There was a great deal of common sense in this man's telling his patient to chew his milk. The loss of the teeth, and the consequent omission of mastication, would only mean the loss of the pleasures of the table, the sensation of taste, the stimulation of appetite, pleasant company, and whatever contributes to our mental and physical exhilaration. This is all we lose—for the food is as perfectly masticated out of the mouth as in it, and it does not matter one particle whether these substances are masticated by the teeth or by some other process. The gain is in the absence of dangerous septic matter which we often find in the mouth—the bacterial organisms which produce cultures; and these are of no harm until they produce cultures. These cultures produce disease in the stomach, and I believe the time will come when it will be found that smallpox is not infectious until it has formed cultures in the mouth. The mouth is the principal medium through which all these cultures are produced, and these germs are taken into the digestive tract and inhaled into the lungs, where they do their injury. The mouth affords the temperature for these cultures, and temperature is the principal thing in bacteriological cultures. These bacteria are taken into the digestive tract with the food, and for this reason it is not necessary that we masticate the food—as has been suggested in this paper—not necessary that we use the teeth, but that we have a perfectly aseptic mouth condition, which can only be brought about by perfect cleanliness. Take the Egyptians, who have the most perfect teeth today, and they use almost exactly, in a limited way, the very process for preserving the natural teeth which I have had the pleasure of presenting to the profession and to the world. The Arabs use sticks such as I have advocated using. Go out into the Exposition grounds, among the Filipinos—people who are supposed to have used the teeth from the time they were able—and have you ever seen anything worse than many of these Filipinos on exhibition here? In very few of these will you find as good a set of teeth as in many of the Europeans who have learned to care for their teeth.

One thing to which I wish to call attention to in the paper, namely, "How many notice the variations from health to disease in the various soft tissues of the mouth, the variations in color, etc.?" "Michaels of Paris and Kirk of Philadelphia are teaching the world how to discern the state of the body through the character of the secretions." Nothing of the kind! The experiments which have been made by these gentlemen in connection with the mouth and teeth only show that it is impossible to diagnose the mouth diseases, systemic conditions, and the condition of the blood by analyzing the saliva. To say they have done one thing on which we can put our finger in the advancement of diagnosing general diseases of the mouth—they have done nothing of the kind; it is utterly impossible. When Dr. Kirk's papers were published in Philadelphia,

you could see the mouths of the whole medical profession drawn in laughter over what was supposed to be the developments of that paper. We do not take the material out of the blood through the salivary glands and analyze it to find what is in the blood. We go directly to the blood. That is what the physician is doing in the diagnosis of typhoid fever today.

He says this is but a temporary matter and too superficial for consideration. No physician in the profession will deny, given parents with perfect teeth, that with care you can produce perfect teeth in the next generation. Make the parents understand what belongs to the preservation and upbuilding of a good set of teeth in their offspring. We have not done our duty in this respect; we have not given them the tooth-brush and the tooth-powder. How are you going to compel the community to chew their food?

Dr. Chas. P. Pruyn, Chicago, Ill. I have listened to the reading of this paper with pleasure and satisfaction. I think Dr. Taylor is to be commended very highly for presenting to us such a paper. There is very little in it to which I can take issue or say any word of condemnation. But in the remarks made by my predecessor it seems to me we have some ideas—I dare not say facts, I dare not say science. He certainly has endeavored to upset all our theories regarding physiology, regarding the use of food, etc.; he has made statements entirely beyond the range of our ideas. He said he had no saliva in his mouth. I wonder if that be normal or abnormal which causes the mouth to be perfectly dry! It did not seem to be because of fear in addressing this body. He speaks of the saliva as of slight value—comparing it with water. This seems to me entirely wrong. I do not know what point he reasons from. He speaks of wrapping saliva about a bolus of milk. I did not know you could put two liquids together and envelop one with the other. Put milk and water together, and they unite in one mixture. Our physiology teaches us the value of the mastication of food. If what he says is true, I think his remarks should be framed and put up at every five-cent lunch counter. It would be an advantage to them, because we have been teaching our people for years that these methods of fast eating were injurious to health. But if we can save the time of eating, and have the food shoved down into our stomachs by mechanical means we ought to know it. He evidently tries to draw a line of demarkation between the kinds of saliva that issue from the different glands. He seems to me to make a distinction without a difference, for in the mouth the saliva from the different glands becomes mixed. He forgets also the nervous influence of the individual. He cites the cause as being hereditary. He says that given a parent with good teeth we should have good teeth in the child. He forgets the influences under which we are living at the present time—the nervous influence of the strenuous life. The energetic life we live has a marked effect upon the digestion of food. Indeed, all of Dr. Smith's remarks seem to me to be exactly opposite to the accepted views of the profession. I want to know just what he means. He does not go far enough; if he has something so much better for the care of the teeth than we know, then it is his duty to tell us just what the methods are that will bring about this delightful condition of things.

Dr. A. O. Hunt, Omaha, Neb. The

paper in its general character pleases me. I do not believe that at this time and in this era of dentistry any individual could present a paper on hygiene of the mouth which would be entirely satisfactory or cause the profession to do much more than has been done for a great many years. The question whether teeth are useful or not seems to me not worthy of discussion. They belong to the animal economy. The first movement that most animals make is to get food; if it be an animal with teeth, the effort is to use those teeth. Education along dental lines has only been going on for a few years. We hear about the wonderful advancement we have made, but when we come to think about it, it has been along mechanical lines mostly, and not for the preservation of the teeth. The well-qualified dentist of today is capable of taking a child at an early age and bringing that child to maturity with a good set of teeth without suffering from toothache or other pathologic conditions which arise in the oral cavity. The profession has reached the ideal that it set for itself fifty years ago—to save the human teeth. I am not one to discourage the efforts of any individual who brings to us any knowledge, or any experiments, or experience, or anything that will lead in the direction of prophylaxis. The statement that clean teeth will not decay is a truism. If they are absolutely clean, decay will not go on. We do not yet know all that we need to know and shall know eventually of the conditions in the mouth, whether infectious or otherwise, but to say that we are in a position to know positively what is causing the destruction of the human teeth is untrue. We can say that the use of the teeth preserves not only the teeth but the gums as well. Many disturbances are present in the mouth that come from different causes, but the use of the teeth is certainly valuable. The statement that the conditions of civilization are producing poorer teeth than in former days is the greatest fallacy. Not many years since, our National Association spent a good deal of money, and many of its members a great deal of time, in examining the evidence that was at hand. The museums of the whole world were studied very carefully, and all the skulls possible were examined, and it is part of the transactions of the National Association today, or should be, that this idea is a fallacy, for numerous evidences are found that all the oral diseases with which we are now familiar have existed in all times and ages. The more highly civilized we are, the better the race. Look at the young people growing up today under modern conditions. Highly specialized food prepared in the kitchen tends to reduce somewhat the use of their teeth, but they are receiving benefits in other ways, and improved modes of living produce a better race of young people than we had twenty years ago. The teeth are better, because more people are interested in their care. I am in accord with Dr. Smith's idea that if the parents were thoroughly instructed as to what is necessary to produce good teeth, the teeth would be better from generation to generation in proportion as the benefits of prophylactic treatment were understood.

Dr. E. E. Haverstick, St. Louis, Mo. There is no doubt that if we had parents properly instructed and who would properly instruct their children, the next generation would have better teeth. The vital question is, How shall we instruct these children? There is but one way, and that is through the public schools and the public press. There is no use

in expecting that because the parents care for their teeth the children will have better teeth, unless they take care of them. When I say "take care of their teeth," I mean the removal of all food particles from the surfaces of the teeth as often as food is taken. Another vital point in the prophylaxis of the mouth is in the saliva itself, because we often find it of acid reaction from the parotid glands and alkaline from the sublingual and submaxillary glands. When we can control the saliva we shall be able to do much for the preservation of the teeth of the next generation.

Dr. Pruyn. I would like to hear a little further from Dr. Smith. He is anxious to clear up some of these points, and I ask that he be permitted to again address the section.

Dr. Smith. One gentleman spoke of these ideas being opposed to our physiological views. I expect them to be; until we have opposing views we shall never make any progress in dentistry. In what direction have we made improvements? In the various mechanical departments and in instruments; in the matters we have talked of this afternoon we are just where we were forty years ago. I read an article in the *Dental Digest* entitled "Dentists Not Readers." I believe it. I published articles along this line, trying to enforce these ideas on the profession. I have written five distinct papers on that subject; I do not believe anyone here has read the five, and doubt whether anyone present has read even one of them. All have been widely published. Truman published two of them. Never were articles published so extensively in the medical world, and they could not fail to make an impression on your mind. I think they are worth reading. They reached out beyond anything published before.

The teeth are for use, but we do not use them; they are not necessary for mastication. They are a great comfort and convenience, and they produce, as has been said, a nervous energy which assists in the digestion of the food. Regarding the submaxillary gland, the mass thrown out by it and injected into the bolus of food is a slimy mass; it assists in deglutition, and it is during this act that the conversion of starch into sugar occurs. It is not to moisten food. Water is just as good. Here lies a patient ready to drop into the grave, and the physician wants to nourish this patient; does he give him food to masticate and insalivate? No, he gives him nourishing and concentrated liquid food, not prepared in the mouth, but in the laboratory.

Dr. Pruyn. Dr. Smith cites the case of a patient at death's door being assisted back to health by concentrated liquid foods, and applies the inference to all conditions of life. I think that is entirely unjust. It is an illustration which does not illustrate; it is faulty. I want to get at the truth in a truthful, square manner.

Dr. Smith. I stand here as the advocate of perfect teeth, and the attempt is made to make it appear that I say teeth are not for use and are of no value. We can make perfect teeth, but not by the process advocated here this afternoon.

Dr. Taylor (closing the discussion). The most perfect teeth the world has ever known are in the animals that never saw a dentist. They simply obey the laws of their being, with no civilization to interfere and divert them from their own laws of being. Men who have observed these laws have had perfect teeth. Any animal which changes its food

habits as man has done will lose its teeth as man is doing. The only perfect teeth are made through necessity. Man had them, but he wandered away from these laws and his teeth deteriorated. I have no controversy with the point Dr. Smith has taken as to the necessity of taking care of our teeth. The laws governing the individual are of small consequence. We know men who without their arms can have others prepared that will convey their food to the mouth, and we might as well say that the arms are not necessary. The individual could live, but the race never, under such conditions. You will find in the study of biology that all depends upon the alimentary canal—that is, the food selected for it. It is here that life differentiates. Teeth will not exist where the necessity for them ceases. The muscles and jaws of man are growing smaller today because he does not use his teeth enough for mastication, and teeth are growing smaller simply from disuse. We must use our teeth if we would keep them.

Adjourned until 2 o'clock Tuesday afternoon.

SECTION IV—Continued.

SECOND DAY—Tuesday, August 30th.

The meeting was called to order by the chairman, Dr. A. H. Peck, at 2.30 P.M., Tuesday, August 30th.

The first order of business was a paper entitled "Notes on the Therapeutics of the Accidents of Extraction," by Dr. JULIO ENDELMAN, Philadelphia, Pa., as follows:

Notes on the Therapeutics of the Accidents of Extraction.

By JULIO ENDELMAN, D.D.S., Philadelphia, Pa.

BEFORE taking up the discussion of the subject embodied in the title of this communication, the author wishes to disavow all claim to originality. The purpose of the paper is merely to review some of the therapeutic methods available in the treatment of the accidents which occasionally follow the extraction of teeth.

In looking over the literature of the subject, the writer finds that the number of recorded cases of post-operative accidents is markedly out of proportion to the great number of extracting operations performed without any attention whatever to the most elementary rules of asepsis. It may be said safely that 50 per cent. of operations for the removal of teeth are carried out in the most reckless way, with instruments not even clean in the ordinary sense of the term, and with the field of operation in as inviting a state for microbic invasion and development as it is possible to have it. These statements are the result of observation in private offices, and with very few exceptions all those that were visited exhibited a degree of carelessness almost criminal.

It is beyond the comprehension of an ordinary mind that men who employ the strictest aseptic procedures in the treatment of infectious conditions in root-canals and in other operations which may be properly designated as of minor importance when compared with the extraction of a tooth, should knowingly jeopardize the lives of patients by neglecting to sterilize their instruments and properly prepare the field of operation. But, fortunately for patients and operators, serious cases of post-extraction ac-

cidents are relatively rare. However, it should be stated that it is extremely difficult to collect reliable statistics on post-extraction accidents, or on any other subject for that matter, for the simple reason that operators are seldom willing to give publicity to failures, particularly as in a large proportion of cases they are the outcome of faulty surgical technique and inefficient aseptic precautions.

This phase of the subject brings us into close proximity to the interesting and far-reaching problems of resistance and immunity, and while we are by no means prepared to express a definite opinion on the factors which in some cases are responsible for the prevention of septic infection, we must state that from a clinical point of view the existence of defensive elements in the salivary fluids and oral tissues is beyond doubt. The resistance of tissues to pathological influences varies in direct ratio to the degree of health of the individual, it being greater the higher the health status, and *vice versa*. This is a point of direct practical importance in the sense that a greater degree of precaution should be observed with patients whose health status is low, and who on this account offer suitable fields for the ingress and development of pathologic micro-organisms. As already stated, the number of post-extraction accidents on record is small. A careful examination of the pages of the *Dental Cosmos* has enabled the author to collect a total of thirty-five cases, subdivided as follows:

Removal of the floor of the antrum: 2.

Contraction of the muscles of the forearm and flexors of the fingers and adduction of thumbs: 1.

Tooth impacted in bronchus—death: 1.

Swallowing of a tooth—death: 1.

Swallowing of a tooth—recovery: 1.

Fracture of maxillæ: 2.

Shock following extraction—death: 1.

Taking cold after extraction—infection: 1.

Migration of stump: 1.

Removal of tuberosity: 1.

Tooth in bronchus—recovery: 4.

Choked by a tooth—death: 1.

Pneumonia caused by a tooth in bronchus: 1.

Paralysis after extraction: 4.

Dislocation of mandible: 1.

Suffocation by swallowing of a tooth during extraction: 1.

Third molar driven into jaw during extraction: 1.

Fracture of palatine bone: 1.

Purulent infection after extraction: 1.

Purulent infection following fracture of jaw during extraction: 1.

Broken piece of forceps left in jaw after extraction—infection: 1.

Death after extraction—infection: 3.

Tooth slipped from forceps into trachea: 1.

Forcing tooth into antrum: 1.

Hemorrhage—death: 1.

It is interesting to note that out of the total of thirty-five cases, eight terminated fatally, a proportion of over 22 per cent. of fatalities. Three of the fatal cases were the result of infection directly traceable to foul instruments. Two were reported by Dr. Zakharevitch (*Vratch*, No. 34, p. 523, and *Dental Cosmos*, vol xxvi, p. 697). In each of the patients, aged twenty-six and twenty-four respectively, the lower second molar was removed. Osteomyelitis developed in one case, and osteitis and periostitis of the mandible in the other. The third fatal case, the result of septicemia induced without doubt by the use of septic forceps, was reported in the German *Quarterly Journal of Odontology*, by Dr. Lanyi. In this case it is possible that the symptoms of general infection were only aggravated by the further introduction of pathologic micro-organisms from the infected instruments. However, a part of the responsibility for this death

must be borne by the operator, inasmuch as the mixed infection which immediately followed the attempt to extraet the tooth was unquestionably the outcome of a septic technique and faulty post-extraetion treatment.

The fourth fatal case oceurred during an extraction, and was probably caused by a strong eardio-inhibitory reflex the result of powerful stimulation of the terminal branches of the trifacial, the impulse traveling to the Gasserian ganglion, thence to the deep origin in the floor of the fourth ventricle, from whence the path to the motor nueleus of the pneumogastric is short and direet. Of the remaining four deaths, three were eaused by the extracted teeth slipping into respiratory passages, and one by a persistent hemorrhage.

These statistics show altogether a total of seven cases of infection following extraetion. Three of these terminated fatally, as described, and four recovered. A total of seven eases of post-extraction infeetion represents a proportion of a little over 20 per eent., a percentage sufficiently large and alarming to warrant a free and liberal discussion as to the best and most practieal means of decreasing, and if possible of entirely eradicating the eauses responsible for sueh results. The author is thoroughly aware of the questionable reliability of statements based upon statistical data, as the proportion of pathological eonditions that may develop in different individuals in a given time eannot be determined by fixed mathematical rules and subsequent deductions. The personal equation is a faetor which cannot be disregarded in matters relating to the life, resistance, pathologie changes, and death of cellular elements; and, as due consideration of this factor eannot be taken into aceount in the deductions that may be arrived at from a series of known eases, statistics are eonsequently useful only in the sense that they portray what the results might be if all conditions were to remain equal.

Post-extraction aceidents may be divided into the eleven following groups:

(1) Fraeture of the tooth operated upon, part of the root remaining in the alveolus and requiring a subsequent operation for its removal.

(2) Fracture or removal of an adjoining tooth.

(3) Fracture of a portion, small or large, of the alveolar arch.

(4) Dislocation of the mandible.

(5) Fracture of the jaw.

(6) Laceration of the gingival tissue.

(7) Wounds of the tongue, lips, and neighboring soft tissues.

(8) Inflammatory phenomena of microbie origin in the alveoli and cellular tissues of the mouth and cheeks, also in the substance of the mandible, produeing osteomyelitis.

(9) General phenomena of infeetious eharacter.

(10) Reflex disturbanees in the regions supplied by the fifth pair of nerves or by cranial nerves having a deep origin in proximity to that of the fifth pair.

(11) Hemorrhages.

The author intentionally omits accidents occurring in the eourse of anesthesia and changes in the position of the teeth and the shape of the dental arches following the injudieious and premature extraetion of deeiduous or permanent teeth.

Groups 1-5. We shall have to omit from this discussion everything referring to these groups, as the treatment of those conditions is entirely beyond the provinee of the dental therapeutist, and shall begin with

Group 6—"Laceration of the gingival tissue." In sueh cases the operator's attention should be direeted mainly to the prevention of subsequent inflammatory and infcctious phenomena. Thc author would recommend the canterization of the lacerated tissue with a zinc chlorid solution of 10 to 30 grains to the ounce of distilled water, and the frequent use of an antiseptic mouth-wash. If a strip of gum tissue be torn it should be removed with eurved scissors, unless it be of sueh a size as to expose part of the underlying bony tissue; in such a case it may be advisable that it should be held in plaee by a few interrupted sutures.

Group 7. In this group we inelude all wounds of the tongue, lips, and neighboring soft tissues inflieted during the operation. They are, of eourse, the outeome of earelessness or unnecessary haste on the part of the operator, and their treatment will necessarily vary aecording to the extent of the injury. One case is recalled in whieh the operator removed a lower tooth and with it a small portion of the tongue! The treatment should eonsist in the use of mild astringent and antiseptie mouth-washes, any one of the following formulæ being available for the purpose:

NO. I.

℞—Salicylic acid,	gr. lxxv;
Alcohol,	℥ss;
Distilled water,	Oj.

Sig.—Use as a mouth-wash three times daily.

NO. II.

℞—Boric acid,	ʒj;
Sodium borate,	gr. xxx;
Rose-water,	℥iv.

Sig.—Usc ad libitum.

NO. III.

℞—Sodium borate,	gr. xxx;
Thymol,	gr. iij;
Distilled water,	℥viij.

Sig.—Usc as a mouth-wash.

NO. IV.

℞—Hydronaphthol,	gr. xv;
Alcohol,	℥j;
Distilled water,	℥j.

Sig.—One teaspoonful in a tumbler of watcr. —T.

Group 8. From the therapeutic standpoint the treatment of aceidents under group 8 is perhaps the most important, comprising those post-extraction phenomena which operators are most likely to cneounter. Inflammatory phenomena, resulting from infection of the alveolus subscquent to the extraetion, or by the retention of the pyogenie sac in the ease of teeth the seat of alveolar abseess, is usually accompanied by severe pain. The onset of the attaek in this type of eases does not oeeur until one or more days after the extraetion. Ineidentally, it may be stated that post-extraetion pain is not always the result of inflammatory phenomena of microbic origin. It is eaused oeeasionally by an undue degree of pressure from coagulated blood against the severed nerve filaments of the alveolus. Acute pain also appears in eases where the bony region, espeeially around a lower tooth, has increased in density as the result of inflammatory proeesses. Extraction of such a tooth will probably be followed by a eertain degree of pain, as a greater amount of physieal force will be required to dislodge the tooth, and the almost unavoidable straining and perhaps laceration of the soft tissues will excite in the gingival mueous membrane a state of inflammation whieh very often spreads, involving parts or all of the floor of the mouth, and perhaps the buccal or lingual mucous membrane, aecording to the location of the tooth or teeth that were extracted.

These cases may eventually beeome the seat of microbic influence if allowed to

go on without proper therapeutic attention. Their treatment is simple and is generally followed by very satisfactory results. The first step should consist in thoroughly curetting the alveolus, thus removing all disorganized tissue, coagulated blood, and alveolar débris, if any be present. The alveolus is then copiously irrigated with hot water, and after drying with cotton an application is made of two drops of pure carbolic acid, and the alveolus is then loosely packed with sterilized gauze. If the pain does not subside, an application should be made of campho-phénique and morphin acetate. A small pellet of cotton is saturated with the campho-phénique, and, after taking up with it a small amount of morphin acetate, is carried to the bottom of the painful alveolus. The morphin-campho-phénique dressing produces most remarkable results in the sense that the pain disappears almost simultaneously with the introduction of the dressing. When inflammation is not very severe, tincture of calendula may be used instead of carbolic acid. The author favors this agent for the reason that it has the power of subduing inflammatory conditions, with the additional property of stimulating the growth of healthy granulations. It has also been recommended to cauterize the alveolus with the electro or thermo-cautery. In one case which came under the writer's observation, temporary relief was secured by the administration of analgin in doses of gr. v every three hours. There are many other agents which may be used in place of analgin, but we give the preference to this compound because it apparently has no depressing action upon the heart.

Analgin is a coal-tar derivative, and chemically speaking is an acetyl-amido-benzol-trimethyl-xanthin. In addition, each dose contains sodium bicarbonate, gr. $\frac{1}{4}$; camphor monobromate, gr. $\frac{1}{4}$; extract hyoscyamus, gr. $\frac{1}{8}$; extract cannabis indica, gr. $\frac{1}{8}$. The hyoscyamus increases the analgesic properties, the camphor acts as a diffusive stimulant, and the cannabis indica is an antispasmodic.

Group 9. The treatment of general phenomena of infectious origin consequent upon tooth-extraction necessitates the exercise of great care and constant attention on the part of the attending physician or dentist. The treatment of this type of infections does not vary in the least from that indicated in infections consequent upon the contamination of other external wounds, except in that it is a much more difficult matter to keep surgically clean an area constantly bathed by a fluid abounding with bacteria both saprophytic and pathogenic. Treatment should consist primarily in the disinfection of the alveolus and neighboring areas with strong antiseptic solutions. Either mercury bichlorid solution 1:2500 or carbolic acid solution 5:100 is a valuable agent for the purpose. The constitutional manifestations should be treated symptomatically. If there be any signs of cardiac depression, tincture of digitalis and strychnin sulfate should be given simultaneously; the tincture of digitalis in doses of 5 to 10 drops, and the strychnin in doses of gr. 1/30 every three hours. Here, as in the case of every other systemic disturbance of a serious nature, careful nursing, hygienic surroundings, and nutritious food to sustain the patient's strength, are factors of the first importance.

Under this division of our subject, it becomes imperative to devote some words to the possibilities of the transmission of syphilis through dentists' instruments.

Dr. R. A. McDonnell, in a paper published in the *Dental Cosmos* (vol. xlv. p. 556), mentions several instances of extra-genital chancres traceable to wounds inflicted by dentists. A chancre of the gum, a chancre inside the cheek, and a chancre at the angle of the lips came under his observation. Dr. McDonnell does not describe the circumstances under which these infections occurred, but his experience is sufficiently indicative of the dangerous consequences of operative intervention with septic instruments. A case of syphilis transmitted by a dental forceps was reported some time ago by Dr. S. S. Cartwright, in the *Medical Record,* and the many other cases which are to be found in medical and dental periodical literature emphasize once more the tremendous risk to which our patients are subjected when operated upon with instruments improperly sterilized.

Group 10. The limitations of time and space applying to the present paper make it necessary to condense the discussion of this group of reflex manifestations to only a word upon that type of cephalalgia which so frequently develops consequent upon the stretching and severing of the nerve filaments supplying the teeth and their alveoli. The irritation thus set up manifests itself in the form of dull headache lasting for one or more days. The therapeutic intervention should consist in the administration of a nervous sedative—aconite in one-drop doses every hour, limiting the total administration to four drops. And here, again, analgin has given the writer most satisfactory results, arresting the pain almost magically, ten or fifteen minutes after its administration.

Group 11—Hemorrhage. This post-operative accident is perhaps the one which has received the greatest degree of attention from investigators and clinicians. When it takes place in comparatively normal individuals it is promptly arrested by such well-known agents as tannin, alum, or the iron salts, in conjunction with packings of gauze, cotton, or modeling composition, and in some cases the extracted tooth itself, as nothing could fit the alveolus more accurately. But we may unsuccessfully exhaust all means at our command in those cases of hemorrhage following the extraction of teeth in the hemophilic. Out of thirty-nine fatal cases of hemorrhage following various operations collected by Grandidier, ten were consequent upon the extraction of teeth. This is a proportion far greater than that from any other operation. In a work by Moreau, published in 1873, we find a total of twenty-six fatal cases following the extraction of teeth in individuals of the hemophilic diathesis. Hemophilia—an hereditary diathesis—is an abnormal state characterized by a marked tendency to hemorrhage owing to a diminished resistance of the walls of the bloodvessels, and to an insufficient degree of coagulability in the blood (Guerini). The treatment should consist in the administration of agents which will cause the bloodvessels to assume a condition of tone, and which will decrease the period of coagulability of the blood.

The first desideratum may be accomplished by the administration of the following preparation:

℞—Vini ergotæ, U. S. P., f℥iv.
Sig.—One teaspoonful every two hours.

The second requirement may be gained by the internal administration of calcium chlorid in doses of gr. x to xx. Wallis (*Journal of the British Dental*

Association, August 1902) reports two cases treated successfully with this calcium compound, and Morley (*Trans. Odontological Society of Great Britain,* May 1903) reports one case treated by large doses of calcium chlorid internally and adrenalin locally.

Viau recommends as a local application the following styptic collodion:

℞—Collodii,	℥iij;
Acid. carbolici,	ʒij;
Acid. tannici,	ʒj;
Acid. benzoici,	ʒj.

Sig.—Apply within the alveolus.

Boggs (*Deut. Arch. f. klin. Med.,* No. 79, 1904), who has experimented with the calcium salts, has substituted calcium lactate for calcium chlorid. It has the same effect on the coagulation time, is tasteless, and is well borne. In one case it reduced the coagulation time from 5 min. to 3.2 min., and in another from 6.7 min. to 3.7 min.

Discussion.

Dr. JAMES TRUMAN, Philadelphia, Pa. This is one of the subjects in which I think dentistry of today is very much lacking. From the earliest period in my experience, dentists have been in the habit of assuming that the fluids of the mouth produce immunity; that they are in a sense aseptic; that we can do anything in the way of injury to the tissue of the oral cavity without bad results. That was the teaching of forty or fifty years ago. We have fortunately outgrown that, and yet I do not know why it is that in the majority of cases there is a practical immunity in injuries of the mucous tissues. In the works of Metchnikoff and of Hugenschmidt of Paris certain theories have been evolved which have only in part been demonstrated, but others have taken up the study. Yet it is not demonstrated why we can do all sorts of things in the mouth and nothing serious result. This, however, is not always the case, and there has come a feeling that there is universal danger in the treatment of all conditions of the mouth. With this, of course, you are perfectly familiar and it is like going over the A B C of dentistry to say that it is necessary to sterilize the instruments.

I remember one case that was very instructive to me—that of a lady who came to the clinic of the institution with which I am connected, and in whom I suspected syphilitic infection. She had a beautiful set of teeth. Upon inquiring into the history of the case, she informed me that she had been under the care of a certain dentist in another state whose reputation for cleanliness was not very high. She had had a bicuspid root removed. From that moment she was a sufferer, and when I examined it I pronounced it a case of necrosis, and there was nothing to expect but the final removal by extraction of the entire set of teeth. Consulting with her medical adviser, I learned there was no syphilitic taint in the family, and that if she had it the affection must have been acquired. It was a case of infection. I make it a rule in pathological treatment at the University of Pennsylvania to avoid, if possible, working on syphilitic patients, and if this cannot be avoided all instruments used must be sterilized by fire before using them again.

Another point in connection with this that I do not think has been given sufficient importance is the use of clamps and ligatures in the mouth. It is a well-

known fact among dentists that before the introduction of clamps and ligatures there was little or nothing known of what is now called pyorrhea alveolaris. After the introduction of these very important instruments—and I would say no word against them—there was an increase of gingival inflammations—an increase, I think, that must have had its origin in microbic poison introduced through the wounds caused by these instruments. A dentist uses a clamp or ligature, and he takes it off and allows the patient to depart. He has produced a positive injury to the gingival border, and inflammations of the mouth inviting the development of micro-organisms. In forty-eight hours you will have an inflammation of the periosteum. That is the local beginning of pyorrhea alveolaris.

The essayist has described extraction of the teeth and treatment of the socket. That is another thing in which I think dentists have been lacking in their treatment. I include myself, for in former years I think I never used anything but a little warm water for the removal of the coagulated blood. We do not hear much about extraction today, and the forceps of the past are rusting in the drawers. In extraction there always exists the danger of septicemia. If it has never occurred in your practice, it has occurred in the practice of a number of others, and we should be on our guard. The causes that originate septicemia are always present after the extraction of a tooth with an abscess. It is a matter of constant surprise that this result does not more often occur.

Dr. Florestan Aguilar, Madrid, Spain. It gives me great pleasure to take part in the discussion of the paper of Dr. Endelman, which I think bears on a very important subject of daily practice. I am only surprised to see in the statistics collected by the essayist the small number of fatal cases recorded resulting from accidents following the extraction of teeth. I myself recollect a case which occurred a few months ago to a fellow practitioner in Madrid, who in trying to divide the roots of a molar with a circular saw to extract them, injured the tongue, and the patient was subjected to a very abundant bleeding. The dentist, in his effort to stop the hemorrhage, used some hemostatic pincers which were not clean, and the result was that infection occurred from which the patient died two days later from septicemia. This case has been recorded in the dental journals.

As Dr. Truman has said, it is of great importance to prevent the possibility of septicemia. I might add that the facilities for infection are great, not only to the patient but to the operator. Dr. Amoëdo of Paris was prevented from coming to this meeting of the congress on account of injury to his eyes from the entry of a piece of tartar in the process of cleaning some teeth. We have record also of a case of septicemia causing the death of a dentist of Berlin who wounded his finger while performing an extraction, with the result that he had to have the arm amputated—but unfortunately too late to relieve him, and he died. I hope in the discussion of this paper we may lay down facts that may impress the general practitioner with the importance of thorough cleanliness of the instruments.

Dr. J. D. Patterson, Kansas City, Mo. While it is true that the mouth in its normal state is able to take care of all sorts of poisonous micro-organisms that may be present in the oral cavity, we

sometimes puncture and injure the mucous membrane, and then certainly the most extreme care should be taken. In the operations for the removal of calcareous deposits, in the application of ligatures, in extractions, in all oral operations for the removal of tumors, and in all pathological conditions in the mouth we should take the most extreme care. We may have gone through life practicing for years without accidents, but they are liable to occur to us. We think we are immune from such experience, but the accident may come tomorrow. The accident of infection Dr. Endelman mentions is one of the worst.

Dr. Louis Ottofy, Manila, P. I. I was very much interested in the valuable paper of Dr. Endelman, and am pleased that I was present to hear it. In tropical climates the subject treated in the paper is of even greater importance than in temperate zones. I have seen a large number of cases of post-extraction infection, from my own hands and from the hands of others. A patient will return in a day or two and complain of constant pain, the wound will be found badly infected, and it requires from six to eight days to obtain relief. The inflammation often extends to the adjoining teeth, and often results in the destruction of considerable tissue. The full extent of discomfort thus caused is not generally known, for patients will go from one dentist to another in the hope of getting relief. This predisposition to infection in the tropics is especially marked in foreigners during the first few years of their residence, while the processes of acclimation are in progress and the system is especially liable to be readily affected. I have seen unfavorable results follow even when I have personally disinfected the instruments used, and when I have availed myself of all the ordinary precautions. It is now my practice to cleanse with a germicide the tissues liable to be injured, to see to the thorough cleanliness of all instruments, and subsequently to cleanse the wound with a solution of mercury bichlorid and also provide the patient with a suitable mouth-wash to be used for several days.

I was especially interested in the various formulæ presented by Dr. Endelman, and shall make use of them on my return to the Philippines.

Dr. T. W. Pritchett, Whitehall, Ill. I do not know if I quite followed the suggestion made as to antiseptic care after all cases of extraction. I think to anticipate all risks and dangers there should be very ample precautionary measures used at the time the wound is made, and particularly with respect to teeth with abscesses, where pus has already formed. When I extract a tooth or teeth I use carbolized hot water, and if there be no abscess developed I take less care than where there is pus. I use carbolized hot water freely, and then if there is a suspicion of pus I flush the socket with a 1 per cent. solution of potassium permanganate or a 10 per cent. solution of chinosol. I wish to ask if that is a safe antiseptic precaution for everyday use. I use carbolized hot water to sterilize the mouth before the extraction as well as after.

Dr. C. W. Rodgers, Boston, Mass. In looking over my library some years ago, I found a paper written about thirty years ago by Dr. Shepard of Boston. In it he made a plea for the dental office as a continual school for dental education, and I think that is one method we have for overcoming the septic condition often following the extraction of teeth. Thorough instruction should be given to the

patient as to the proper care of a wound after extraction. The general surgeon who has a case of adenia will in most instances insist that the patient remain in the hospital at least a week, and yet the extraction of a badly abscessed tooth, surrounded by diseased tissues, is of greater danger to the welfare of the patient. We should educate our patients as to the serious results that may occur; if we will make a point of instructing our patients, they will tell others.

Dr. L. A. Meyer, Oconomowoc, Wis. I am glad that I came into this section this afternoon. This question is one that has troubled me for fifteen years. Whenever a patient presents himself with a serious look on his face and a swollen jaw, I become at once troubled and ask myself, Shall I extract that tooth or wait? My practice is to cleanse the mouth thoroughly with hot water and an antiseptic solution. If I am satisfied that pus is present, I lance and try to get it out of the tissues. Then I consider the wisdom of extracting the tooth. After extracting I thoroughly cleanse again with hot water and antiseptic solutions, and then place a drop of lysol on a tampon of cotton in the socket. In severe cases I have left this tampon in the socket for a day. I then examine and again wash out the wound, and then dismiss the case or may repeat the same treatment. Often patients come to me for extractions whom other practitioners have refused. I invariably follow these instructions and am careful both before and after extracting. I had one case of a patient with an infected first molar; inflammation of the periosteum had set in and the soft tissues around the mandible were swollen and hard. The tooth was loose and it required no effort to remove it. I used an ichthyol tampon in the socket and dismissed the patient. I was asked next day to visit the patient at his house, and as no improvement had taken place I irrigated the wound with carbolized hot water for about twenty minutes, and the tissues became quite soft under this treatment. I prescribed a saline cathartic, and placed the ichthyol tampon, but the tissues still continued hard. A physician friend of mine treated this case for about three weeks. At first he thought we would have to remove a part of the mandible. The physician called my attention to the fact that there was a history of tuberculosis in the family. I did not think I was to blame in this case. I have been in the habit of taking out these teeth in the early stages of inflammation. Hot water and camphorated phenol or a lysol tampon seem to allay the pain in these cases. I want to thank Dr. Endelman and the others for the suggestions made.

Dr. Endelman (closing the discussion). As to my statistics, I desire to say that they are by no means complete. They merely embrace a number of reports published at different times in the *Dental Cosmos*. I took these as a basis upon which to work, and I think they plainly show the dangers that may follow the use of unclean instruments.

I did not intend in my paper to discuss the treatment that should precede the extraction of teeth, as its primary object was to discuss the accidents of extraction, not pre-extraction treatment. I thoroughly agree as to the necessity of sterilizing the mouth before extracting or before any other surgical operation. Regarding carbolized water, I do not consider it sufficiently strong for that purpose. It may be sufficiently strong to make the surround-

ings unfavorable to the growth of micro-organisms, but it will not destroy all the germs already present. I prefer something of the oxidizing type, like potassium permanganate, or H_2O_2, although for obvious reasons I am opposed to the injection of hydrogen dioxid into the alveoli of extracted teeth.

I also heartily approve of examining the patient a day or two after the operation is performed. It seems to me that if we neglect to do so we are not doing the best we can for our patients. To perform an operation and then abandon the patient to the mercies of chance is neither scientific nor professional.

As to the extraction of teeth the seat of abscesses, I feel that it is a part of surgical procedure, and whether an abscess be in the mouth, in the intestinal tract, or in any part of the body, the cause must first be removed. If we discover that an abscess cannot be eradicated, the next best thing we can do is to remove the affected tooth. I stated in my paper that very severe pain is often felt after the removal of a tooth thus affected, frequently because the abscess sac remains within the alveolus even after the removal of the tooth. Due attention should be given to the alveoli after extraction.

I am absolutely opposed to the use of ichthyol. It is an unpleasant preparation made from fossilizing fishes as found in different parts of the world, and its taste is extremely unpleasant.

A paper entitled "Dental Hygiene in the Danish Army and Navy," by Dr. V. WIGH, Copenhagen, was read by title. The paper in full here follows:

Dental Hygiene in the Danish Army and Navy.

By V. WIGH, Dental Surgeon at the Garrison of Copenhagen.

IN the year 1897 the Dutch dentist, Dr. Stark of Amsterdam, came to Copenhagen and delivered at the Scandinavian Congress of Dental Surgeons an enthusiastic lecture on the necessity of introducing dental hygiene in the army and navy. From a series of answers to questions put by the lecturer to all the European governments, it appeared that in those countries nothing whatever had been done in the above-mentioned matter. Only from the Surgeon-General of the Danish Army had Dr. Stark received a letter telling him that already on April 1, 1896, a consulting room for dental and oral diseases, thoroughly up-to-date in every way, had been set up in the military hospital of Copenhagen. Thus Denmark may justly claim the honor of being the first European country where the military authorities have fully realized the importance of dental hygiene in the army and navy.

In the consulting room of the military hospital all diseases of the teeth and mouth are being treated. It is open every day to officers, non-commissioned officers with their wives and children under eighteen, and to private soldiers of the garrison. Admission to treatment in the consulting room is obtained in the following way: Every morning when the doctors that are on duty appear in their respective barracks all sick persons are pre-

sented to them; those who need treatment by specialists are then given a sick certificate and sent to the respective specialists at the military hospital (all of whom have their consulting rooms in the hospital building). The men of the army and navy are also furnished gratis with artificial teeth, if in each special case a medical certificate warrants the necessity for inserting artificial teeth for curative reasons.

During the eight years that have elapsed since the introduction of dental hygiene at the military hospital of Copenhagen, 9557 patients have been treated for dental disease and the number of consultations have been 20,374.

During the last sitting of the Danish parliament, the Government succeeded in getting voted 5000 kroner ($1333) a year for the dental hygiene of the army and navy, and from this spring dental surgeons will be permanently attached to all the garrisons of the country. Thus Denmark will probably be the first country where military dental hygiene has been systematically adopted.

A paper by Dr. M. Ricer, Svendborg, Denmark, entitled "Examination and Treatment of School Children's Teeth in the Municipal School of Svendborg, Denmark," was read by title. The paper in full here follows:

Examination and Treatment of School Children's Teeth at the Consulting Room for Dental Diseases in the Municipal School of Svendborg, Denmark.

By Dental Surgeon M. RICER, Svendborg, Denmark.

From nearly the whole world, from both physicians and dentists, statistics are forthcoming regarding the state of school children's teeth, and the facts deduced from these apparently dead figures are so astounding that no doubt it is time that means should be found to ward off the coming danger implied by these ominous results.

The fact is that in many schools the number of children with normal teeth is only 5 to 15 per cent., whereas the rest, 85 to 95 per cent., are affected with caries or other dental diseases.

In Denmark well-to-do families have long realized to their cost the necessity of having children's teeth periodically overhauled; but among the municipal school children things are quite different, the parents being as a rule unable to afford even a conservative treatment of their children's teeth.

Being well acquainted with this fact when more than seven years ago I started my work in the boarding school at Svendborg, I made a point, First, to examine the children of this school (then about 1200) in order to find out how many of them had diseased teeth, especially caries or other dental diseases; Second, to point out how many of the patients could be offered immediate assistance, whether medicamental or operative. The local authorities (the headmaster of the school

and the mayor of the town) thoroughly realized the importance of this cause; so on December 4, 1896, by permission of the town council, a room, an operating chair, and the necessary medicaments were put at my disposal in the school house that I might treat the children. Thus a consulting room was established where at certain times the children could have free treatment of dental diseases.

Of course one must not imagine that by the term "consulting room" is meant an ideally arranged establishment where the children are treated according to the most advanced methods of gold and enamel filling, such a thing being naturally impracticable. The idea is simply this, that children whose parents are poor or badly off may be offered free treatment for dental diseases. The treatment is meant to be chiefly operative, but in cases where conservative treatment (filling) is urgently needed the patients are always treated at my private consulting rooms.

For the disinfection of instruments, rinsing of the mouth, etc., I use creolin, a cheap and reliable antiseptic, and on all occasions I enjoin on the children the usual directions for the hygiene of the mouth and teeth.

Furthermore, I arranged that twice a year the children of the upper forms are to write dictated exercises dealing with the principal rules of dental hygiene. I think that such exercises cause the children to reflect, and certainly these written rules are more easily remembered than lectures.

Once a month all the children of one class are examined and those who can be assisted—whether the second dentition ought to be regulated or the teeth want filling—are told that they may be treated by me every Friday morning from eight to nine in the consulting room of the school. One of the mistresses kindly assists me at my weekly consultations in the school and at the monthly examination of the children. Besides, each one of the present 1350 pupils at the school is allowed to call on me in the consulting room of the school.

In cases where the filling of a tooth is of urgent necessity the parents are acquainted with this fact, and in many cases the children then come to my private consulting rooms to have their teeth filled. It sometimes happens that the parents do not allow the children to have their teeth filled, whereas they always thankfully accept any offer of dental operations.

The record for these seven years shows to what a great extent help has been administered, and clearly proves that these poor children do not suffer less than the rest of the population. An account is kept of the patients treated in the consulting room and from this journal are extracted the following tables of treatments for dental diseases during one year from December 4, 1902, until December 4, 1903:

Operations. Extractions of milk teeth, partly to relieve pain, partly in order to regulate the second dentition (in shedding period), 697. Extractions of the first molar on account of deep caries and in most cases on account of pericementitis, abscesses, and fistulas, 166. Extractions of other permanent teeth on account of tooth injuries or in order to regulate the teeth, 27.

Medicamental and surgical treatments. Permanent fillings, treatments of decayed teeth by temporary fillings—formalin, gutta-percha, etc.; treatments of diseases in the cavity of the mouth—gingivitis, stomatitis, abscesses, and cleaning

of the teeth, 209 treatments. In addition have been made during the last five years four regulating appliances for the use of four pupils on account of irregular teeth.

The number of patients during the last seven years is as follows: 1897, 683; 1898, 467; 1899, 515; 1900, 543; 1901, 803; 1902, 750; 1903, 834. Total, 4595 patients.

During these seven years the 4595 patients have been given the same treatments in about the same proportions as stated for the year 1902-1903. The number of pupils in the school *pro tem.* is about 1350.

During the last year the consultations fell as follows: Ordinary consultations, held in the consulting room of the school, 43; private consultations, held at my private consulting room, 81. Total, 124.

The following tables are the summary results of my examinations of the children in the school of Svendborg in 1897, and will show the average state of mouth and teeth. In the register are entered the names of the 1200 children and beside each name are rubricated entries showing the number of carious teeth (deciduous and permanent) with a separate rubric for the first molar, another for the diseases found in the cavity of the mouth and neighboring organs, if originating from the teeth and gums, and finally one for the irregularities that have been observed. A note is made about the general state of health if the child is found to be anemic or rhachitic. Of 1111 recorded cases of examination, I give the following:

SUMMARY.

	Girls.	Boys.
Normal teeth	84	107
Carious teeth	441	479
Anemia	71	52
Rhachitis	6	19
Mouth diseases*	26	19
Irregularities†	25	19

As for this brief account of my efforts, it is my hope that it may become an effective spur so much needed for furthering a most important cause; for no doubt this abnormal state of things can be remedied only when dentists are permanently attached to the schools.

My work in this cause I regard not so much as an example to be followed by other dentists as an appeal to the municipal authorities and an experiment intended to show how practicable the system is, how easily it works—in short, a precedent from which experience may be gathered and of which duty bids us make a rule in a not too distant future.

With this end in view public attention must be aroused. Neither the municipal authorities nor even the state should be kept in ignorance of what might be done in a cause of such vital importance to the people.

The Chairman announced as the next paper that by Dr. LOUIS OTTOFY, Manila, P. I., on "International Examination and Tabulation of the Condition of the Teeth of Public School Children." The paper here follows:

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* Diseases of the cavity of the mouth or adjacent organs.

† Irregularities of the teeth, second dentition, or the jaws.

International Examination and Tabulation of the Condition of the Teeth of Public School Children.

By LOUIS OTTOFY, D.D.S., Manila, P. I.

I.

Report of Examination of the Teeth of Filipinos and Chinese in the Public Schools of Manila, P. I.

In presenting this report regarding the prevalence of caries among school children, I believe this to be the first report of this nature relating to the teeth of children belonging to other than the Caucasian race. I trust that this may lead to a systematic and uniform plan of making these records of all races and nationalities in the world, as outlined by me in the second division of this paper.

It is still an unsettled question to what extent racial, national, social, economical, geographical, sexual, hereditary, and other influences affect the condition of the teeth. As in later life various causes contribute to certain modifications, such as the occupation of the individual, care of the teeth, education, general health, etc., it seems to me that the most reliable data must be sought in the children of today, who are the men and women of tomorrow.

While human nature is similar the world over, in none is the similarity more marked than in children, who play, study, and act their part alike, uninfluenced by the artificial modifications which become operative after maturity. The children I examined in North Dakota in 1882, in southern Illinois in 1883, and in Chicago in 1885, were in their demeanor nowise different from the Filipino and Chinese children which I examined in 1902, and upon whom I report in this paper. Everywhere the boys are bolder and more readily submit to the examination, while the girls at first shrink with a modesty alike in them all. The teachers everywhere show the same interest, offer facilities for accomplishing the work, and treat the examiner with the same uniform courtesy. I have no doubt that if I compared notes with others who have done similar work, I would find that their experience in England, Germany, France, Sweden, or any other country, in nowise differs from mine.

A sufficient number of these examinations have been made to lead me to the following conclusions:

(1) That tooth-decay in girls is more frequent than in boys. The cause of this should be determined and the remedy applied.

(2) That the teeth on the left side are in a slight degree more prone to caries than those of the right side.

(3) That the retention of carious temporary first and second molars are the certain causes of caries of the permanent first and second bicuspids.

(4) That the first permanent lower molar is, before the fifteenth year, in an appalling condition. Of 986 specimens of these teeth covered by this examination 705, or 61½ per cent., are carious.

(5) That the removal at the proper

[International Dental Examination Blank.]

TABLE 1—*Males.*

A TABLE SHOWING THE CONDITION OF THE TEETH OF 250 PUBLIC SCHOOL CHILDREN OF THE FILIPINO RACE, IN THE CITY OF MANILA, PHILIPPINE ISLANDS, MARCH 1902.

DR. LOUIS OTTOFY, *Examiner.*

Temporary. Sound.

Age.	No. Examined.	R. 5	4	3	2	1	L. 1	2	3	4	5
6	8	3 3	4 3	6 5	4 4	2 4	1 3	2 6	4 6	5 2	2 2
7	16	6 4	6 4	6 8	4 3	2	2	3 4	9 8	4 3	6 2
8	17	3 2	2 1	8 7	4 1	2	2	5 2	6 7	3	5
9	23	8 5	5 11	7 14	3 2			1 2	6 11	7	1 4
10	45	13 7	7 7	13 11	1 1			3	15 13	7 6	13 5
11	31	5 6	2 5	7 11					6 10	3 3	6 5
12	47	2 2	1 1	4 1					3 1	1 1	1 2
13	35	1 1	1						2		2
14	21										
15	7										
	250	71	60	108	27	10	8	28	107	45	56

R. 276 L. 244 — 520

Permanent. Sound.

Age.	R. 7	6	5	4	3	2	1	L. 1	2	3	4	5	6	7
6		4 3	1	1		2 2	2 4	2 5	2 2				4 3	
7		11 8	1	2 1		5 11	10 12	9 12	2 11		2 1	1	12 8	
8		9 9	6 4	8 6	3 3	9 15	14 17	15 17	8 13	2 7	7 8	5 6	13 8	3
9		16 6	4 3	6 6	2 5	16 20	20 22	22 22	17 20	3 5	9 5	6 3	12 8	1
10	9 9	12 15	24 15	23 23	21 22	32 43	36 43	36 43	33 43	18 28	20 24	19 20	27 16	9 9
11	6 11	17 7	23 12	24 16	20 24	29 31	29 31	29 31	30 31	18 19	16 21	21 15	17 7	5 10
12	20 16	25 20	35 29	34 41	34 41	44 47	41 47	42 47	42 47	42 42	33 37	37 34	26 19	20 11
13	20 12	21 13	30 28	30 33	29 35	32 35	33 35	32 35	31 35	33 35	29 35	27 27	19 12	17 8
14	10 7	15 6	19 18	18 20	21 21	20 21	20 21	19 21	19 21	20 21	17 18	21 18	13 6	12 5
15	5 5	5 2	6 7	6 7	7 7	7 7	6 7	6 7	6 7	7 7	5 6	5 5	4 2	5 2
	130	224	265	305	293	416	439	452	418	297	293	269	237	112

R. 2072 L. 2078 — 4150

Total Sound, 4670

Temporary. Carious.

Age.	R. 5	4	3	2	1	L. 1	2	3	4	5
6	4 5	3 5	2 2	1 2	2	4	2	4 2	2 5	6 5
7	7 7	7 7	6 6	6 3	4 1	5 1	4 1	6 7	7 11	7 10
8	7 6	7 8	5 6	2			2	10 2	7 9	8 6
9	11 8	7 9	11 2	1 5	2	2	6 1	11 4	11 11	15 12
10	8 8	6 9	7 4	1			5 2	8 3	8 13	7 11
11	4 5	2 5	5 1	1				3 2	3 5	9 4
12	4 4	2 2	3 1					3 2	4 2	5 2
13	2		1							3 1
14							1			
15		1								
	90	80	62	22	9	12	23	67	98	111

R. 263 L. 311 — 574

Permanent. Carious.

Age.	R. 7	6	5	4	3	2	1	L. 1	2	3	4	5	6	7
6		1 3											1 2	
7		3 7										1	2 6	
8	1	6 8	1 2	1							1		4 9	1
9		7 17	1	2 1							1	1	11 15	
10	4 7	13 30	1 4	2 2		6	9	9	4		7 3	1 1	18 29	4 10
11	3 4	14 24	3	1 1		2	2	2	1		3	1 4	14 24	5 5
12	12 18	22 27	5 6	7	1	3	5	5	5		7 2	4 6	21 28	12 25
13	12 21	14 22	2 3	5 2	1	3	3	3	4	1	4	4 4	16 23	14 21
14	9 13	6 15	2 3	3		1	2	2	2		4 2	3	8 15	6 13
15	2 2	2 5	1				1	1	1		2 1	2 2	3 5	2 5
	108	246	34	27	2	15	22	22	17	1	37	34	254	123

R. 454 L. 488 — 942

Total Carious, 1516

Age.	Temp.—Sound.	Temp.—Carious.	Perm.—Sound.	Perm.—Carious.	Total No. Teeth	Per cent. Sound.	Per cent. Car.
6	33 38	30 26	18 19	2 5	73 88	60	40
7	44 40	59 54	55 64	6 13	164 171	60	40
8	40 20	48 37	102 113	12 23	202 193	70	30
9	31 56	77 52	133 126	22 34	263 268	66	34
10	72 50	50 50	305 349	78 86	505 535	75	25
11	29 40	26 23	284 266	48 65	387 394	78	22
12	12 8	21 13	475 477	109 112	617 610	79	21
13	6 1	6 1	383 378	86 96	481 476	81	19
14		1	254 224	45 64	300 288	78	22
15		1	84 78	17 20	102 98	81	19

GRAND TOTAL, 6186

SOUND TEETH, 75.50 per cent.

CARIOUS TEETH, 24.50 per cent.

[International Dental Examination Blank.]

TABLE II—*Females.*

A TABLE SHOWING THE CONDITION OF THE TEETH OF 250 PUBLIC SCHOOL CHILDREN OF THE FILIPINO RACE, IN THE CITY OF MANILA, PHILIPPINE ISLANDS, MARCH 1902.

DR. LOUIS OTTOFY, *Examiner*.

Temporary. Sound.

Age.	No. Examined.	R. 5	R. 4	R. 3	R. 2	R. 1	L. 1	L. 2	L. 3	L. 4	L. 5
6	10	3	2	4					5	4	4
		1	2	4	4	3	2	5	4	1	1
7	33	13	13	18	6	2	3	6	14	10	10
		4	0	19	8	1	2	11	18	6	4
8	16	5	3	5	2	1	1	3	4	3	5
		3	3	6	2	1	1	1	6	3	2
9	25	2	3	9	1			3	9	2	2
		5	3	8	1			3	9	2	2
10	47	5	7	9	1			1	10	6	6
		4	4	6					7	5	6
11	27	1	1	1							
		1		1							
12	31	2	1	1							3
		1	1	2							
13	27	1	1	1							1
				1					1	1	1
14	25	1									
15	9								1		
	250	53	50	95	25	8	9	33	88	43	47

R. 231 L. 220 — 451

Permanent. Sound.

Age.	R. 7	R. 6	R. 5	R. 4	R. 3	R. 2	R. 1	L. 1	L. 2	L. 3	L. 4	L. 5	L. 6	L. 7
6		7				2	3	3	2		1		4	
		4				3	7	6	3				2	
7		10	4	1		5	16	14	7				13	
		7	2	1	2	24	33	30	21	2			10	
8		6	1	3		10	12	14	7		4		5	
		4	4	3	4	15	15	15	15	3	1		4	
9	1	10	6	13	7	18	21	20	19	7	11	6	7	2
	2	1	6	11	12	25	25	25	25	12	8	7	1	1
10	5	23	20	31	25	42	43	43	41	25	33	21	20	5
	8	10	20	31	36	47	47	47	47	34	28	16	9	4
11	10	11	19	20	22	23	22	22	23	22	22	17	14	9
	11	8	18	22	24	27	27	27	27	27	23	20	7	12
12	14	14	23	24	28	26	21	21	26	28	22	21	10	12
	13	5	25	25	28	31	31	31	31	30	26	25	4	9
13	6	9	20	22	25	26	24	24	25	24	21	19	9	6
	3	5	23	25	25	27	26	26	27	25	22	20	7	8
14	12	8	22	21	25	20	19	19	19	25	21	22	8	11
	4	6	23	24	25	25	25	25	25	25	25	22	6	6
15	1	5	7	8	9	9	7	7	7	9	9	9	6	3
	2	3	8	9	9	9	9	9	9	9	9	9	3	2
	92	156	251	294	306	414	433	428	406	307	285	234	144	92

R. 1946 L. 1901 — 3847

Total Sound, 4298

Temporary. Carious.

Age.	R. 5	R. 4	R. 3	R. 2	R. 1	L. 1	L. 2	L. 3	L. 4	L. 5
6	7	7	5	8	7	7	7	6	5	5
	7	6	5	2	1	1	2	3	7	5
7	19	16	13	20	11	11	18	16	21	21
	23	22	8	2			2	12	22	24
8	9	5	6	3	1	1	3	10	8	11
	7	8	4					4	8	10
9	16	9	6	6	2	3	1	8	8	17
	7	11	7	2	1	1	1	3	13	10
10	21	9	7					8	6	20
	21	11	3					5	11	17
11	3		1	1				2	3	4
	2	3	1						1	1
12	1	1							2	2
	2	1							1	2
13										2
	1	1								
14										
	1									1
15										
										1
	151	110	66	44	23	24	34	77	116	153

R. 394 L. 404 — 798

Permanent. Carious.

Age.	R. 7	R. 6	R. 5	R. 4	R. 3	R. 2	R. 1	L. 1	L. 2	L. 3	L. 4	L. 5	L. 6	L. 7
6		1											4	
		6											8	
7		18									1	1	18	
		24									2		22	
8		10					2						11	
		12	1									1	12	
9		15		2		2	2	2	1		1		18	
	1	24	1								2	2	24	1
10	2	24	4	2		5	4	4	6		4	3	27	2
	3	37	3	2							2	6	38	7
11	3	16	3	6		4	5	5	4		3	5	13	4
	11	19	1	1							1	1	20	10
12	9	17	4	6	1	5	10	10	5	1	6	6	21	10
	14	26	2	2							3	3	27	17
13	17	18	3	3	1	1	3	3	2		5	4	18	16
	22	22	2				1	1				2	20	8
14	11	17	3	3		5	6	6	6		4	2	17	11
	21	19	1									2	19	19
15	7	4	1			2	2	2					3	6
	6	6											6	6
	127	335	29	27	2	24	35	33	24	1	34	37	346	117

R. 579 L. 592 — 1171

Total Carious, 1969

GRAND TOTAL, 6267

Age.	Temp.—Sound.	Temp.—Carious.	Perm.—Sound.	Perm.—Carious.	Total No. Teeth	Per cent. Sound.	Per cent. Car.
6	22	64	22	5	113	53	47
	27	39	25	14	105		
7	95	166	70	38	369	50	50
	79	115	132	48	314		
8	32	57	62	23	174	59	41
	28	41	83	26	178		
9	31	76	149	43	199	62	38
	33	56	161	55	305		
10	45	71	377	87	580	67	33
	32	68	384	98	582		
11	3	14	256	71	344	78	22
	2	8	280	64	354		
12	7	6	290	111	414	74	26
	4	6	319	94	333		
13	4	2	260	94	360	76	24
	4	2	269	78	353		
14	1		252	91	354	77	23
		2	262	81	345		
15	1		96	27	124	80	20
		1	99	24	124		

SOUND TEETH, 68.60 per cent.

CARIOUS TEETH, 31.40 per cent.

time of temporary teeth when carious, or their salvation by filling, has a most salutary effect on the permanent teeth.

(6) That few persons reach the age of fifteen years with sound teeth.

In this paper I shall merely state the general conclusions regarding the condition of the teeth of the 250 Filipino girls and the same number of boys, and invite your attention to a perusal of the statistical tables incorporated in this report.

My work was confined merely to a distinction between carious and sound teeth, and the extent of the remedies applied in the way of filling, and the extraction of carious teeth—all teeth extracted or filled being reckoned as carious teeth. Of absent temporary teeth no record is made, as it is impossible to determine whether their loss is due to the course of nature or has been brought about for the alleviation of suffering. When the first permanent molar, however, has been extracted it is counted as being carious, as for no other reason would it be removed at an age of less than fifteen years.

The total number of teeth of both sexes of the Filipino children was 12,453, distributed as follows: Males, 6186; females, 6267; total, 12,453. Of these, there were—

	Sound.	Carious.
In males	4670	1516
In females	4298	1969
Total	8968	3485

showing that the average of carious teeth in males is 24.50 per cent., in females 31.40 per cent., and in both sexes 27.95 per cent., which in my opinion is somewhat larger than the average in Europeans and Americans; this may be due possibly to the fact that in 500 children having 3485 carious teeth, only *two children* and *three teeth* had received dental attention!—a record of a lack of dental care not paralleled by the report of any other examiner.

The total amount of dental work I found may as well be enumerated. Not one of the 250 boys had had any dental attention whatever, except the extraction of some of the first permanent molars. Of the girls, one had two amalgam fillings, and another one gold filling. This is the sum-total of dental service. One girl had a gold crown on one of the superior lateral incisors—placed there, as she informed me, on a sound tooth, for esthetic (?) reasons—and another had a dental ornament, so called, which is worse than useless. These ornaments consist of a piece of gold in the shape of a heart (possibly nearer pear-shape), to the reverse of which two small flat pieces of gold are soldered! These projecting pieces are introduced between the interstices of the incisors and bent in opposite directions, and the ornament is held by them in place. In course of time they become loose, and are taken in and out by the wearer, and placed between any other teeth, or for special occasions

TABLE III.

PERCENTAGE OF SOUND AND CARIOUS TEETH IN MALES AND FEMALES.

(Fractions of per cent. omitted.)

AGE.	MALES.		FEMALES.	
	Sound. Per cent.	Carious. Per cent.	Sound. Per cent.	Carious. Per cent.
6	60	40	53	47
7	60	40	50	50
8	70	30	59	41
9	66	34	62	38
10	75	25	67	33
11	78	22	78	22
12	79	21	74	26
13	81	19	76	24
14	78	22	77	23
15	81	19	80	20

loaned to a friend. I have been informed that they have the advantage (?) over fillings, in that they can be moved about in various parts of the mouth, or laid aside altogether! Jewelers make and insert them at a cost of three pesos ($1.50 U. S. currency).

present at the same age in white American and European children, in 14,000 of whom the average was a little less than 23 per cent. The larger number present in the mouths of Filipinos may be due to the fact that a number of carious teeth which in white children would be re-

TABLE IV.

GENERAL SUMMARY.

	RIGHT.	LEFT.	RIGHT.	LEFT.	TOTAL.	PER CENT. CARIOUS.	
						RIGHT.	LEFT.
SOUND TEETH.							
Males.							
Temporary	276	244	. . .	. . .	520	. . .	. . .
Permanent	. . .	. . .	2072	2078	4150	. . .	. . .
Females.							
Temporary	231	220	. . .	. . .	451	. . .	. . .
Permanent	1946	1901	. . .	. . .	3847	. . .	. . .
CARIOUS TEETH.							
Males.							
Temporary	263	311	. . .	. . .	574	46	54
Permanent	. . .	. . .	454	488	942	48	52
Females.							
Temporary	394	404	. . .	. . .	798	49	51
Permanent	. . .	. . .	579	592	1171	49	51

Grand Total, 12,453.
Average carious, in both sexes: Right, 48 per cent.; Left, 52 per cent.

For a detailed statement of the condition of all of the teeth in each sex, your attention is invited to Tables I and II. The percentage of sound and carious teeth in males and females at various ages is given in Table III, while Table IV gives a general summary of the condition of all the teeth in comparison between male and female.

The number of teeth to each child was 24.9, slightly in excess of the number

moved are in the cases of Filipinos suffered to remain, for want of care and education on the subject, or possibly through earlier eruption of the teeth due to the more rapid maturing of races of tropical climates.

Out of a total of 250 boys only 13 had every tooth sound, and of the same number of girls only 11—showing that less than one-half of one per cent. of the children had sound teeth.

TABLE V.

(A) FUSED TEETH.

AGE.	SEX.	TEETH FUSED.
8	Male.	Lower right temporary lateral and canine.
8	Male.	Lower left temporary lateral and canine.
12	Male.	Lower left temporary lateral and canine
9	Female.	Lower right temporary lateral and canine.

(B) SUPERNUMERARIES.

AGE.	SEX.	POSITION.
10	Male.	Between superior central incisors.
11	Male.	Between superior central incisors.
12	Male.	Between superior central incisors.
14	Male.	On labial surface of superior left lateral incisor.
11	Female.	Between superior central incisors.

TABLE VI.

PERFECT SETS OF SOUND TEETH.

AGE.	SEX.	SOUND TEMPORARY TEETH.	SOUND PERMANENT TEETH.
7	Male.	16	24
10	"	10	13
10	"	1	27
11	"	. .	28
11	"	18	6
12	"	. .	28
12	"	. .	27
12	"	. .	22
13	"	. .	26
13	"	. .	26
13	"	. .	27
13	"	. .	28
14	"	. .	28
7	Female.	15	8
8	"	20	4
10	"	5	18
10	"	9	17
11	"	. .	25
11	"	. .	28
12	"	. .	26
13	"	. .	28
14	"	. .	28
15	"	. .	28

Of malformations and other dental peculiarities, only two kinds were found, namely, fusion of the temporary lateral incisor and canine, invariably the lower, and supernumeraries, invariably in the upper incisal region. (See Table V, *A* and *B*.) Perfect sets of teeth are given in Table VI.

CHINESE.

While visiting the schools to examine Filipino children, I accidentally came into a Chinese schoolroom, where I examined fifty boys (no Chinese girls attend public schools in Manila). I merely report what I found, placing but little value, in a sense of comparison, on the data secured. The Chinese community in Manila is peculiar and in no wise representative of the race. In a total population of 22,125 Chinese, there are but few pure-blooded Chinese women—being variously estimated at from one to three hundred. Many Chinese are married to Filipino women, and rear a mixed race, but the fifty boys here referred to were pure Chinese. In age they ranged from six to nineteen years—and there were too few of them at any age to make the data obtained conclusive. On the whole, the condition of their teeth was better than among Europeans, Americans, or Filipinos, being 78 per cent. sound and 22 per cent. carious. Eight of the boys, ranging between eight and eleven years of age, had each only one tooth carious, and that one belonging to the temporary set which would shortly be shed; while six boys, or 1½ per cent., had perfectly sound teeth. If the eight boys mentioned be considered as having each shed the solitary temporary carious teeth, the percentage of boys dentally sound would be 28 per cent.—the largest percentage of sound teeth ever found by any

examiner in a similar or larger number of children. But it should be borne in mind that these children are of a class above the average, well fed, of prosperous parents, clean and neat in their person and attire, and living on wholesome food according to Chinese ideals.

The total number of teeth examined was 1258, of which 966 (94 temporary, 872 permanent) were sound, and 292 (86 temporary, 206 permanent) carious. Table VII contains the more important details regarding these fifty Chinese boys.

TABLE VII.

GENERAL SUMMARY OF CHINESE.

AGE.	NUMBER OF BOYS EXAMINED.	PERFECTLY SOUND TEETH.	
		Temporary.	Permanent.
7	2	. .	.
8	1	. .	. .
10	6	12	12
11	4	12	12
12	5	. .	.
13	4	. .	. .
14	13	. .	27
15	10	4	20
16	3	3	25
17	1	. .	. .
19	1	. .	32

Abnormalities: One seven-year-old boy, lower right temporary lateral incisor and canine fused. One fourteen-year-old boy, supernumerary between the superior central incisors.

The grand total number of teeth reported on in this paper is as follows:

Sound teeth	9,934
Carious teeth	3,777
Total	13,711

II.

Plan for a Uniform Periodical Notation of the Condition of the Teeth of School Children in All Countries.

The earliest records of any attempt having been made to determine the condition of the teeth of a number of persons, outside of a dental office, so far as I know, are those of Magitôt, published in 1867, and relating to the condition of the teeth of recruits for the French army. Since that time some examinations have been made in public institutions such as hospitals for the insane, deaf, blind, etc. It was not until 1882 and 1883 that any systematic examinations of the teeth were conducted in public schools, for the purpose of determining the condition of the teeth in youth. This work was at that time conducted simultaneously, and without the knowledge of one another, by Julius Parreidt in Germany,* and by myself in the United States.† Since that time a large number of such examinations have been conducted by members of the profession in various countries, such as Great Britain, France, Germany, Austro-Hungary, Sweden, Norway, Switzerland, Belgium, and others, and quite recently by myself, among the Malays of the Philippine Islands.

These examinations and tabulations were made by members of the profession in various countries, men who were interested in this work; practically each one devising an individual system for himself, and covering a larger or less diversified field of inquiry. Thus in my own examinations made more than twenty years ago, I secured data regarding the reaction of the saliva, parotid, submaxillary, sublingual, and mixed, all separately, the time of test, A.M. or P.M., or how long before or after a meal, the density of the enamel, the presence of salivary calculus, the diseases of the soft tissues, irregularity, and the prevalence of caries, as to ages and as to the teeth

* PARREIDT, Zahnärztliche Mittheilungen, aus der Chirurgischen Poliklinik, Leipzig, 1882.

† OTTOFY, Transactions of the Illinois State Dental Society, Chicago, 1883.

themselves. The inquiry included name, sex, age, color, nativity, and occupation of father, mother, and subject, color of hair and eyes, a description of the features, occlusion, a memorandum regarding the subject's general health, a memorandum of the color of the caries, the calculus, and the teeth, the supposed density of the tooth-substance and the enamel, a note of all abnormalities, the degree of cleanliness maintained, whether the subject uses a tooth-brush and dentifrice, number of fillings, unsalvable teeth, grooves, pits and stains of the enamel, and in fact every possible condition was inquired into. I submit a form of the blank used for this purpose, showing the comprehensiveness of the work. [This blank is that which was published at page 180 of the "Transactions of the American Dental Association for 1888."] In my recent examinations the information sought relates simply to the prevalence of caries according to age and sex.

The objects with which various gentlemen undertook the examinations are also variable; thus some endeavored to ascertain whether the character of the soil had any influence, or rather the presence or absence of certain minerals in drinking-water in specific localities; others, from the standpoint that the social status and the degree of civilization attained has a marked influence; while still others, merely to get relative data and ascertain whether the teeth of one nation are better than those of another, and, if so, to what the difference may be attributed.

I desire to bring to the attention of this section, the proposition that the work be conducted as an international undertaking, and that, for the purpose, uniform rules be laid down which shall govern all examiners in all parts of the world, that the examination be confined to an exact given number, and that for the present the inquiry shall go no further than to ascertain the relative proportion of caries and number of fillings in males and females from six to fifteen years of age, inclusive. For this purpose I submit a form of a blank. [Same form as shown filled in as Tables I and II.] These blanks should be printed identically alike, in different languages and one hundred in a book. For facilitating the making up of the records, which is tedious and entails considerable labor, the books for males may be of a slightly larger size than those for females, while the various ages in each sex, aside from being plainly printed on each book, may be more readily distinguished by difference in the color of the paper. Thus an examiner would be provided with ten books, say six by eight inches in size, containing one hundred blanks each, and each book's blanks of a different color, for males, and a like number of books similarly made, but of a smaller size, for females. He will then have twenty books of one hundred blanks each, or a total of two thousand blanks, which gives exactly one hundred for each age and sex from six to fifteen years, inclusive. On entering a school room, the examiner will be confronted with children who may range in age from six to eight years. By examining all the boys in that room in succession, the examiner will have three or four of the books before him and, if he enters each child in the book provided for his age, the final making up of the tables will be a very simple matter. The same is then followed out all through the various grades, until each book is filled.

As I have stated, various examiners have commenced and finished at different lines of investigation, and the reports printed, therefore, also vary, and for uses

of comparison these reports are somewhat unsatisfactory. Some have reported the number of teeth examined and not the respective ages, while others give the number of children examined and not the number of teeth. All the records at this time in this city at my disposal are as follows, and where the information is omitted it has been impossible for me to secure it:

Name of Examiner.	Number of Children Examined.	Number of Teeth Reported on.
Berten	3,337	
Fenchel	323	
Ottofy	623	14,644
Parreidt		(about) 13,000
Pedley	3,145	" 70,000
Röse	7,364	179,087
Unghvári		23,900
Voerckel & Weber	5,003	114,865
	19,795	415,496

As will be seen, in some cases the number of children is given and not the number of teeth, while in others the number of teeth is given and not the number of children. Only three examiners, Röse, Voerckel and Weber, and Ottofy give the exact number of each. Their reports when compared show the proportion of teeth to each child examined, which is as follows:

NUMBER OF TEETH TO EACH CHILD.

Röse	24.1 per cent.
Voerckel & Weber	22.8 "
Ottofy	23.5 "

This table shows an average of a fraction less than 23.5 per cent. teeth to each child. If, therefore, examinations were conducted in say one hundred cities of the world according to the plan outlined in this paper, the total number of children examined would amount to a grand total of 200,000 children and represent a grand total of 4,700,000 teeth, which would be ample for purposes of future comparison. These examinations should be conducted everywhere as nearly simultaneously as possible—for instance, during the month of January, and annually continued. It is not expected that the same children be examined, but children of the same age and sex. The report of this work should be made through the dental publications from year to year, and furnished, *in extenso,* for the entire period covered from the Fourth to the Fifth International Dental Congresses. The field thus covered for the present would show:

(1) Comparative condition of the teeth of children in various countries of the world.

(2) Comparative improvement or degeneration from year to year.

(3) The number of fillings, showing by comparison, the benefits derived by additional care, if any, from year to year.

I have devised a tally sheet, a copy of which was published in the "Transactions of the American Dental Association," 1888, facing page 180. On this sheet in the space for each upper and lower tooth one hundred teeth can be checked. From the book of one hundred blanks, the examiner checks on one of these sheets all the sound teeth of one age and sex; on another the carious teeth, etc., all through the ages of both sexes; the figures are then transferred to the record blank. The entire outfit for the examination of one thousand boys and one thousand girls would consist of the following: Twenty pads of one hundred blanks each, forty tally sheets, and two final record blanks (one for each sex). The two final sheets would be all that is necessary to be sent to the committee of the congress for compilation.

I did not have these tally sheets de-

[*Outside cover for books containing the examination blanks.*]

INTERNATIONAL DENTAL EXAMINATION

Country ....City or town..............................

Name of examiner..

Date of examinations, from ....190 ,

to.......... ....190 .

MALES. Age ....

The report of these examinations should be sent

to ....Street, No........................

City.......................................Country............................

on or before....................................., 190 .

[*Second page of cover.*]

INSTRUCTION TO EXAMINERS

Make exactly 100 examinations of the teeth of children in the public schools, of each age and each sex, from 6 to 15 years of age inclusive.

MALES			FEMALES		
Age	6	100	Age	6	100
"	7	100	"	7	100
"	8	100	"	8	100
"	9	100	"	9	100
"	10	100	"	10	100
"	11	100	"	11	100
"	12	100	"	12	100
"	13	100	"	13	100
"	14	100	"	14	100
"	15	100	"	15	100
		1000			1000

Confine the examination only to the condition of the teeth as to caries and fillings, marking each tooth, as indicated on the back of each blank.

NOTE. In making up the final reports from these blanks, extracted teeth of the permanent set should be counted as if affected by caries. No record should be made of absent, unerupted or extracted temporary teeth, as it is, as a rule, impossible to determine whether their loss is due to normal or abnormal causes.

As at the ages over which these examinations extend the third molar is seldom present, that tooth is represented by a circle, and when the tooth is present that fact can be noted in the circle.

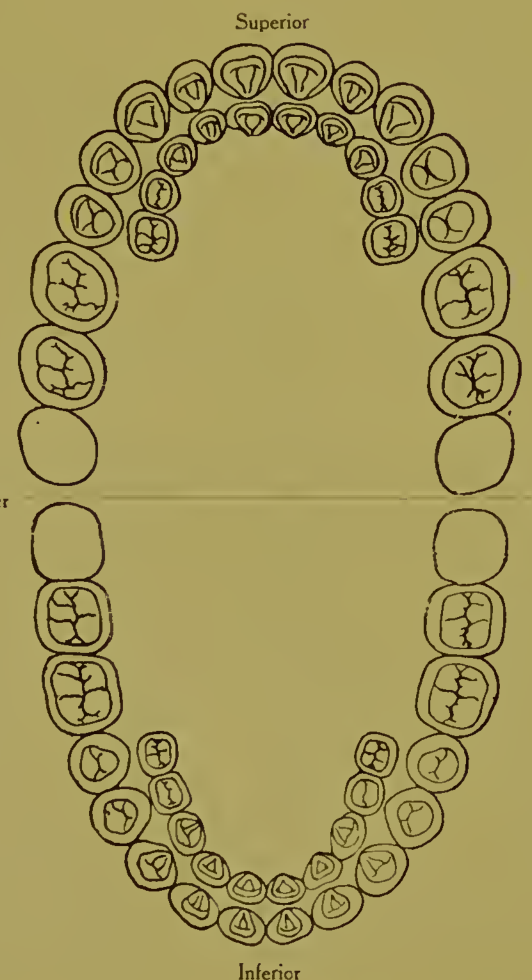
Malformations, such as the fusion of two crowns, the presence of supernumerary teeth, etc., should be noted on each respective blank, as well as any other information in regard to any particular abnormal condition.

[*Third page of cover.*]

DEFECTS, ABNORMALITIES, REMARKS, ETC.:

....

....



[*Fourth page of cover.*]

ABBREVIATIONS

"C"=***Caries***
"S"=***Sanus*** (healthy, sound)
"X"=***Extractus*** (extracted, removed)
"A"=***Abest*** (absent, not erupted)
"F"=***Filling***

vised; nor the final record blanks constructed until the work was under way, nor did I make the examinations on convenient blanks, and the work connected with the 500 children, covering over 12,000 teeth, was something stupendous. I believe that by the simplification and system suggested in this paper the work would be very easy and not require too much time. I am able to give some idea of how much time an examiner would consume in completing the work for 2000 children from the beginning until the completion of the final record sheets, as I kept a record of my time consumed in the school room, but not of the other work, which as stated, was done without an adequate system. This computation is exclusive of the time consumed in going and coming from the various school houses or the time consumed in securing the permission to make the examinations: Examination in school rooms, 75 hours; transferring record to tally sheets, 40 hours; transferring tally record to final record, 5 hours; recording anomalies, etc., 2 hours; total, 122 hours.

Three hours per day in the school room during one month (exclusive of Sundays, holidays, etc.), or one and a half hours during two months, and the same time per day for another month, ought to be ample to examine 2000 children, covering 46,000 teeth, and make a complete, concise report on them, as is contemplated by this paper.

In closing, I suggest that this section recommend to the congress the appointment, under certain rules and restrictions as to the filling of vacancies, appointment of examiners, etc., a permanent committee of the congress to hold over until, and to report to, the Fifth International Dental Congress.

This paper is accompanied by—

(1) Form of blank showing scope of examinations of twenty-two years ago. [This blank chart is that which was published in the Transactions of the American Dental Association, 1888.]

(2) Form of blank proposed for international examinations. [Same in blank as Tables I and II on pages 72 and 73.]

(3) Form of tally sheet, facsimile of tally of examination of teeth of 500 Filipinos by the writer. "On this form tally from the examination blank all the sound teeth of one age and one sex, on another all the carious teeth of one age and sex, then add the number and enter on record blank. As shown, 100 teeth can be checked in each column, upper and lower."

(4) Form of final report, facsimile of the report of the above-mentioned 500 Filipinos.

(5) Form of cover, containing instructions to examiners. [See pages 80 and 81.]

Discussion.

Dr. H. L. Ambler, Cleveland, Ohio. I think Dr. Ottofy deserves very high praise for the amount of work he has done and also for putting the matter in such form that it can be examined in a systematic way. It is the best and most systematic arrangement of anything of the kind I have ever seen or heard of.

Dr. Geo. E. Daniels, San Francisco, Cal. I listened to this paper of Dr. Ottofy with much pleasure for the reason that we in San Francisco have made great efforts to secure such statistics. We have met with a great deal of difficulty in being able to present the subject to the boards of education. In order to do that, perhaps it is better for us to have a little

better understanding of the subject ourselves.

Dr. Julio Endelman, Philadelphia, Pa. I consider myself fortunate in having had the opportunity of listening to the very interesting paper by Dr. Ottofy. It was Dr. Magitôt of France who was the first to systematically compile statistics on the condition of the teeth of the inhabitants of the different regions of France. The work has been taken up again in recent years by several men, prominent among them being Röse of Munich. These statistics show that the teeth of children are as a rule in an extremely neglected condition. I find in studying these statistics that caries of the lower right first molar exists in over 70 per cent. of the number examined by Förberg of Stockholm.

There is a permanent commission, of the existence of which you are probably aware, it being a branch of the International Dental Federation, and I would make the suggestion that the contents of this paper be referred to that commission, so that they may be aware of the work being done in that part of the world in which Dr. Ottofy resides. I think I voice the sentiments of all here, and certainly I speak my own, when I say that we feel grateful to Dr. Ottofy for his interesting and careful investigations and tabulations.

Dr. Ottofy (closing the discussion). This is, in my judgment, an important work and ought to be done the world over. One of the results which will be noticeable within a few years is the following: By calling the attention of the masses to the poor condition of the teeth, it will lead to the introduction of a larger number of fillings, the removal of teeth and roots which are detrimental to the general health of the mouth, and this will promptly result in the reduction of the number of carious teeth from year to year, as will be unmistakably shown by the annual records. Naturally such published facts will lead to a pleasant rivalry between large cities, and especially between neighboring towns, to see which one can make the most rapid improvement in the condition of the teeth of its community.

The next order of business was the reading of another paper by Dr. Louis Ottofy, Manila, P. I., on "Oil of Ylang-ylang as a Dental Remedy," as follows:

Oil of Ylang-Ylang as a Dental Remedy.

By LOUIS OTTOFY, D.D.S., Manila, P. I.

Inasmuch as ylang-ylang has never been used as a medicinal agent, and therefore no description of the tree and flower or the oil distilled from the latter is accessible to the medical or dental student, I deem it advisable to preface a description of its medical properties by giving a botanical *résumé* and such other facts relating to the commercial phase of the subject as I have been able to obtain.

The term *ylang-ylang* means the "flower of flowers." The tree from which the flowers are taken is known as the *Cananga odorata* and belongs to the natural order of *Anonaceæ*. The oil dis-

tilled from the flowers is known as ylang-ylang oil (sometimes spelled "ilang-ilang" and also "yhlang-yhlang"), oleum anonæ, oleum canangæ, oil of cananga, and essence of ylang-ylang. The tree is indigenous to the entire south of Asia and the Philippine Islands. The first knowledge of the tree reached European literature through the investigations of John Ray (1628-1705). It was transplanted from Sumatra to the botanical gardens at Calcutta in 1797, and in 1809 the trunk of the tree was thirty-six inches in diameter four feet from the ground and proportionately tall. The tree attains an average height of sixty feet, the trunk is straight throughout, with smooth bark, and having but few profusely ramified diverging branches; the young shoots are round and smooth. The leaves are short-petioled, drooping, ovate-lanceolate and acuminate, with their margins entire but waved and slightly downy along the nerves of the underside. They are arranged in two rows, and attain a length of four to seven inches and a breadth of two to three inches. The handsome and conspicuous flowers are in fascicles, generally three, sometimes four, on short peduncles from the axils of the leaves or the shoots of the former year's growth and from the nodes of leafless branches. These large bell-shaped, gradually drooping flowers are of a pale yellow or greenish yellow color and possess a most exquisite perfume, which is frequently compared to a mixture of hyacinth, narcissus, and clove, and sometimes to a mixture of jasmine and lilac. The lobes of the tripartite leathery calyx are finally recurvate. The six lanceolate petals soon spread out flat and grow to a length of two and three-quarters of an inch and a breadth of about half an inch, and are longitudinally veined. The filaments are somewhat numerous. The elevated receptacle is slightly flattened or depressed on the summit. The green, berry-like fruit is formed of fifteen to twenty rather long-stalked separate carpels, which inclose from three to eight seeds arranged in two rows.

The first correct description of the plant was made in 1829 by Blumie. Notwithstanding the superb odor of the flowers and the feverish search of the entire Malay Archipelago for useful commercial products, the distillation of the oil was not begun until the sixties in the last century, on the island of Luzon in the Philippines, and the oil first reached Europe in 1864, when in Paris and London its choice fragrance received immediate recognition. It was, however, first brought to general notice by an exhibit of the oil at the Paris Exposition of 1878.

The distillation is carried on principally on the island of Luzon, in the Philippines, and on the island of Java. Where the trees are crowded and uncultivated they produce less oil and that of a minor fragrance. The yield is said to be approximately six drams of the oil from thirteen pounds of the flowers (twenty-five grams of oil from five kilograms of flowers)—hence the oil is very expensive; the value given at the custom house in Manila (probably underrated) is a fraction of over twenty dollars in United States currency per gallon. On this point the information I have been able to secure in Manila is extremely variable. I have been informed by good authority that five hundred pounds of the best flowers will yield two pounds of the best oil, and that the value of this product is fully twenty-five dollars United States currency per pound. However

that may be, I find that the distillation, and in fact the whole business, is in the hands of a very few, and that certain technical knowledge is essential to produce the best results. Since the American occupation several Americans have entered into the enterprise, and as the trees are prolific in the production of flowers, I presume that a larger production of the oil, with more scientific methods than those hitherto employed, will in the course of time increase the supply and correspondingly decrease the value of the product.

The following statistics from the annual report of the collector of customs of the Philippine Islands give some idea of the amount of oil produced, to what countries exported, value in United States currency, etc.:

Exports of Ylang-ylang, 1902 and 1903.

	1902.	1903.
To France	$63,279	$101,566
" United States	11,243	9,621
" England	800	2,880
" all other countries	9,283	9,125
Total	$84,596	$123,192

Of this amount $122,721 worth was exported from Manila and $471 worth from Cebú.

In the distillation of the cananga flower, at first the most volatile ethereal elements containing oxygen pass over, and these contain the odoriferous particles, while with a higher temperature the minor and less desirable products, such as the sesquiterpenes, pass into the receiver. On the island of Luzon and in Java the first product or best oil is known as the oil of ylang-ylang, while the later product (or when it is inseparable from the first) is known as cananga oil. The gathering, selection, and distillation of the flowers, on account of the volatility of the odoriferous particles, requires considerable care and technical knowledge. Very few distillers are able to produce an excellent oil of equal consistence and value. Although ylang-ylang oil is the product of low-temperature distillation, thus containing the ethereal products, while in cananga oil the sesquiterpenes predominate, the difference between them is said to be rather quantitative than qualitative.

The first analyses were made in 1873, by Gal, who found benzoic acid in the oil, thus showing that benzoic acid is present in an ethereal state. Reychler, who made more thorough analyses of the ylang-ylang and cananga oil, found also present in the same state acetic acid. Of alcoholic constituents, which are probably united with the acids, there have been found linalool and geraniol, which have been isolated. The oil is insoluble in water, partially so in alcohol, and entirely so in ether. The characteristic odor of the oil is somewhat dependent on the presence of the methyl ether of paracresol, as also cadinin and pinene. There are also present phenols and sesquiterpene hydrates. In addition to these bodies there is present a very small quantity of something resembling bisulfids, but whose chemical nature is not yet determined. The violet color reaction which the oil gives with iron chlorid is due to traces of phenols, whose isolation would require large quantities of this expensive oil.

The oil sent out from Manila, in the neighborhood of which city the trees are cultivated with a view to producing the best oil, is of light yellowish color and of extraordinary pleasant odor, with a specific gravity of 0.930 to 0.950. As the odor depends largely on the presence of the ethers, the saponification number in a good oil should range from 75 to

120. Treated with iron chlorid the alcoholic solution should give a violet reaction. Ylang-ylang oil coming from other places than Manila varies considerably; some of that examined by Gal came from the West Indies and indicated a specific gravity of 0.980, while oil from Réunion indicated 0.974.

By reason of the value of the product, many attempts at adulteration are resorted to. Used for this purpose is cocoanut oil, which is readily detected by various chemical analyses showing negative results, and also by the simple method of refrigeration with salt and ice, when the product so adulterated assumes a "buttery" consistence.

The discovery, on my part, of the possible value of ylang-ylang as a dental remedy was entirely accidental. A German came to my office, on a Tuesday, to have me attend to two teeth which were paining him. On examination I found the pulps nearly exposed, and, with a view of saving them, after removal of the caries, I applied the usual treatment, and desired to make an appointment for the following Friday. In answer to this request I received the startling reply that it was not necessary for him to come on Friday—"as on that day his teeth would not ache." This statement aroused my curiosity, and I wanted to know how he could tell on Tuesday that the teeth would not ache on Friday. He simply stated that on Mondays, Wednesdays, and Fridays he drew off the ylang-ylang, and that then his teeth would not trouble him. Further inquiry showed that he was employed in an ylang-ylang distillery, and was a specialist in the work; and that on the three days mentioned, by reason of his inhalation of ylang-ylang in drawing it off with a pipette, he inhaled sufficient of the ethereal products to prevent pain, notwithstanding the fact that the cavities were filled with débris. I secured some of the oil from him, and commenced to experiment with it.

It is a source of regret to me that sufficient facilities do not as yet exist in this city for me to test the germicidal and antiseptic properties of this oil. It being considered merely as a perfume, no examination of this kind has ever been made; and one of the objects aimed at in the writing of this paper is to have someone take up the matter and ascertain just to what extent the oil possesses these properties.

In my practice the oil has replaced such remedies as the oil of cassia, cinnamon, gaultheria, thyme, and almost creasote and carbolic acid. From practical tests, it seems to me that there is no essential oil which I have been in the habit of using to which the oil of ylang-ylang is not superior in medical virtue as well as in agreeable and satisfactory effect upon the patient. I have kept it sealed in a putrescent pulp-canal for a period of six months—to find it upon removal as odoriferous as when introduced. There apparently seems no end to its persistence.

I trust that someone with the proper facilities at hand will investigate and report upon the theoretical phase of the value of this drug—for I feel that I may now so term it. The cities of Paris and Berlin, whither the bulk of the oil is exported, should be favorable fields for this purpose.

Literature.

1. J. Chas. Sawer, F.L.S., "Odontographia." London, 1892.

2. Von E. Gildemeister u. Fr. Hoffmann, "Die Aetherischen Oele." Berlin. 1899.

3. "Report of the Collector of Customs for the Philippine Islands, 1903."

The following three papers constitute the report of the Committee on the Care of the Teeth of the Poor, directed to report to Section IV:

I.

On the Care of the Teeth of the Poor.

By THOMAS FILLEBROWN, M.D., D.M.D.,
PROFESSOR OF OPERATIVE CHEMISTRY AND ORAL SURGERY, HARVARD UNIVERSITY.

(Being the Report of the Chairman of the Committee on the Care of the Teeth of the Poor, presented to Section IV.)

THE care of the teeth of the poor is a problem which has for many years occupied the minds of interested men of our profession. A few of our philanthropic citizens also have shown interest in the subject. While the justice and necessity of the establishment of some definite means of meeting the public need has long been acknowledged, the problem of how it is to be done remains unsolved.

To the realization of any scheme to this end there are several obstacles which must be considered. Philanthropic citizens have failed to recognize to any considerable extent the need of such care beyond the mere giving relief from pain; their money has not been given to include more than this one-sided form of charity. The poor themselves are not interested in any care of the teeth beyond securing their immediate comfort. Treatment means discomfort, which the indifferent poor are disinclined to submit to, save when it is absolutely necessary to gain relief from pain. The value of a tooth as a member of their physical economy does not appeal to them.

Another obstacle is the disinclination—the inability, perhaps—of a sufficient number of men of our profession to give their time and effort to this purpose. The physician gladly gives his services to a clinic, because it means an actual gain in money return, experience, and reputation, while his private practice does not suffer from his interest in charity work, as the remaining time at his disposal is ample to attend to the conduct of his business. The work of the dentist, on the other hand, is so much more of the mechanical that every hour means so many dollars. Time given to public service cannot be made up by extra diligence. Few men in full practice can be expected to give up so much of their income as this service requires. In large cities a sufficient number of young men who have not yet established large practices can be found to give enough of their time to meet the needs of the infirmary.

Your chairman believes that constant oversight of the mouths and teeth of patients is as much the duty of our hospitals as the care of any other part of the human system, and that no board of trustees of any hospital is doing its duty while not providing a dental clinic in the out-patient department of the hospital. The logic of this proposition is so very simple that no argument could make it clearer. No extra building is required; no extra trustees or other officers are

needed; no additional financial staff is to be provided.

The friends of dentistry in New Haven, Conn., recently made a movement on this plan, and it seems as though they might succeed. A citizen of New Haven gave several thousand dollars to establish a dental clinic at the hospital in that city. A room was assigned for the purpose and fitted up with modern appointments. Dr. E. S. Gaylord has general oversight of the work and appoints the operating staff. Volunteers for the work are at present abundant. Time will prove the stability of this experiment.

Some years ago a dental clinic was established at the Eye and Ear Infirmary in Portland, Me. It flourished for a while, but after a time volunteers ceased to present themselves and the service languished. An interesting and instructive feature demonstrated by this clinic was the fact that the poor for whom it was primarily designed did not apply for its services. The nurses in the infirmary and in the Maine General Hospital furnished the larger number of the patients. The failure of the clinic was due mainly to the small size of the city where it was established. New Haven is so much larger a city that I predict for the clinic there a long life.

A series of questions was sent to the members of the committee, asking their opinions on the best means of securing a systematic care of the teeth of the poor. These questions brought from Dr. M. L. Rhein of New York the following:

"The solution of this matter lies, I think, in the establishment of distinct dental clinics separate from other institutions either of a hospital nature or of an educational character. I do not believe the so-called clinics of the dental schools reach the real poor. The ideal plan is to have a fund sufficient to endow a dental hospital for the treatment of the worthy poor who are unable to pay for service. The staff of operators should consist of dentists who will give a certain amount of their time for this beneficent purpose. There should be no charges except for the actual cost of precious metals that may be used."

Dr. Jackmann of Ohio offers the following suggestion:

"I believe that cities should be divided into districts, and there should be district dentists as there are district physicians for the poor. The poor of any district would be expected to go to the office of the district dentist during the hours of his free clinic. This dentist is expected to look after the sick poor of his district as any practitioner looks after the sick among his regular patrons. The people should be taxed to pay for this work, and free service given to those only who are absolutely unable to pay for it.

"The recent graduate would be glad for such a place if he were assured of a certain stipulated income for, say, half his time. The other half he could give to practice-building. If the city or county would secure the service of these young men for, say, half their time, and this to cover a period of five years, and then give place to new recruits, I think the teeth of the poor could be cared for. Our dental college in this city is doing something for the poor, but not systematically. Of course the above arrangement would apply to the county as well, making the district larger.

"The public can hardly be reached through the public schools. The schools are so crowded now that to attempt anything more would be confusion worse confounded.

"The clinic for the poor should be wholly free. The class immediately above them are 'ne'er do weel,' but can pay something, and if that something is not exacted they become mendicants much to their own hurt in many ways. There are plenty of young men in our cities who have abundance of spare time and who would be glad to work for this class in their offices for what remuneration they could give.

"I do not think it possible for local dental societies to establish permanent dental clinics, for the simple reason that the local society would lack funds."

Dr. Geo. B. Perry of Illinois assisted your chairman by communicating with a number of his friends. The substance of their replies is embodied in the following paper from Dr. Ernest Bicknell, General Superintendent of the Chicago Bureau of Charities:

"We are of the opinion that the neglect of the teeth of the poor is a subject of greater importance than is usually recognized, and believe that systematic efforts to provide against this neglect are highly desirable. Several years ago the Chicago Bureau of Charities entered into an arrangement with a committee of dentists, of which Carl Theodor Gramm was chairman, to establish dental clinics in several of the Bureau's branch offices. Dental chairs were accordingly placed in three of our offices, one in each division of the city, and dentists volunteered their services and agreed to alternate in being in attendance at the offices on certain days and hours. The experiment was conducted for two or three months but was not successful. The indifference of the poor themselves to their own need was the prime cause of the failure, although irregularity and non-reliability on the part of some of the dentists in keeping their appointments had something to do with the lack of success. Our experience and observation during and since that experiment has led us to doubt the wisdom of establishing a dental clinic in the office of a charity society. Many people who would patronize a clinic elsewhere will not come to a charity office. Again, those who should pay a small fee for services rendered resent paying any fees to a charity society and feel that they are being imposed upon. An independent dispensary or clinic would be free from these objections. We feel that independent clinics, if established in parts of the city distant from dental colleges, should be in response to a demand rather than in advance of it; otherwise the plan will almost certainly fail.

"The idea of reaching the public in an educative way through the public schools we regard as excellent. We suggest also that the numerous social settlements scattered about a city in the poorest sections could be of great assistance should they be properly interested. Popular lectures in the public day schools, night schools, before clubs and classes in the settlements, etc., would all help in the educational campaign which must precede any large systematic, practical efforts. As the demand gradually develops we would suggest that individual dentists be enlisted to provide free service, or service at a nominal fee, in their own offices. When the demand in a given section of the city has reached a sufficient stage of development, an independent clinic could then be created by the interested dentists and the charity work which had been performed by the group individually could be transferred to the one place. This plan would enable you to select the proper location for such a clinic with certainty, whereas if the clinic

were established in advance of the demand there would be no definite means of determining its best location. We do not believe in free clinics, but feel that the rule should invariably be in favor of the payment of a small fee. Exceptions can be made in properly proved or certified cases of need, but the free work should always be the exception and not the rule."

Replies were received from the following, whose ideas are all embodied in the above report: George W. Cook, Eugene S. Talbot, Charles Zueblin, Gertrude F. Howe, Julia Holmes Smith, N. P. Colwell.

II.

Dentistry for the Poor in Public Institutions.

By E. E. HAVERSTICK, D.D.S., St. Louis, Mo.

(Being the author's contribution to the Report of the Committee on the Care of the Teeth of the Poor, presented to Section IV.)

Dentistry for the poor in public institutions has been grievously overlooked. The orphans' homes, eleemosynary, and penal institutions have not had the dental attention which they should have.

Realizing, however, my limited space in this paper, I do not wish to go into detail concerning the above-named institutions further than to say that the tooth-brush and tooth-powder in these institutions are as important as soap and bath towels. It is a poor institution which will give an inmate a clean shirt to wear and not a brush with which to clean his teeth.

Of course, these institutions should have dentists who would visit them two or three times a week and do the necessary dental work; but, until they can be put on this ideal plane, let them at least be provided with dentists who will visit the institutions and lecture to the inmates on the care of the teeth, and let it be required by their superintendents that teeth are to be kept clean as well as faces and hands. The lecture system would be of particular value in the orphans' homes, where children are to be dealt with, and dentists would gladly volunteer to give such lectures.

Dentistry has, in a general way, kept pace with the rapid improvements in other lines; but it has by no means gained the prominence in the public schools that it justly deserves. If we would elevate dentistry to that high position which the profession is truly justified in occupying, and would have every other profession and art bow reverently to it, we must place the fundamental principles in the hands of the *public school teachers.* This point cannot be emphasized too strongly.

We must educate the people with regard to the care of their teeth in the same manner as we educate them along other lines—physiology, general hygiene, etc.; that is to say, by introducing into our public schools a course of dentistry such as each person should practice in his own home. In other words, a course of instruction in oral hygiene and oral anatomy.

In order to introduce such a course into our public schools it will be necessary to amend the school laws so that the teachers will be required to pass an ex-

amination on the proposed new subject. The amendment should make the law so strong on this point that no teacher who does not understand the laws of oral hygiene, who does not know the ill results of too early extraction, of too long retention of the temporary teeth, and who does not know that the first molar is a permanent tooth and how important it is, would be permitted to enter the schoolroom to instruct children. The teacher should know the number of temporary teeth; the time of the eruption of the permanent; the anatomy of the teeth; the results of the death of an unattended dental pulp; that swelling comes from devitalized teeth; know *how to cleanse the teeth,* and such general things as these, so simple and yet so very important. She should be required to instruct the children on the above-mentioned points and try to interest them in their teeth—the organs most essential to health, beauty, and happiness. She should be required to examine the teeth of her pupils and determine their cleanliness and soundness. These examinations should be made in a superficial manner every morning and a careful examination made once a week.

Such requirements added to our school laws would force our normal schools and all schools which prepare teachers to introduce into their course of instruction a course in oral hygiene and oral anatomy, because the object of these schools is to prepare teachers to meet the demands made of teachers. This course would create chairs in these schools which could be filled by doctors of dental surgery only.

Education is the only means by which we shall ever be able to care for the teeth of the poor, or even put the teeth within our reach to care for them. If we were all millionaires and did not need the money, there are not enough of us to do the actual dental work which should be done in the months of the poor within reach of our offices. Much less are we able to do the work in our present situation. Neither would the poor people, uneducated with regard to their teeth, care particularly to have us do the work. But if we will introduce an effective course of instruction into our schools, such as I have briefly outlined, and teach the children the value of their teeth and how to cleanse them, they will appreciate our services whether gratis or otherwise, and we shall have clean mouths presented for operation. Education would create a demand for better dental work, elevate dentistry, and shut out quackery.

Who will take upon their hands the work of introducing this system into the schools? Dentists—for they are the only ones who know how it should be done. What do the people know about what dentists write and say? They never have an opportunity to read anything that dentists write, or hear what they say, except in their offices. This is a mistake; articles of much interest and value could be written for the daily papers and become a great means of educating the people.

If we can influence the poor to keep their teeth clean we shall thereby prevent more decay of the teeth than we shall ever have time to fill in any kind of clinics we can organize. Such influence will have to be created by education in public institutions and daily newspapers. Let us to the work!

III.

Free Dental Service for the Sick Poor.

By WILLIAM H. POTTER, A.B., D.M.D.,

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(Being the author's contribution to the Report of the Committee on the Care of the Teeth of the Poor, presented to Section IV.)

THE sick poor are in need of dental care. Sickness predisposes to degeneration of tooth tissue, and leads to exposure of the pulp and its death. The pain which results either from exposure or death of a pulp is sufficient to cause severe suffering for the sick person and much impede the progress of recovery from the particular disease with which he may be affected. Dental pain is serious enough for a well person, how much more serious to the already sick. Every practitioner must have become impressed with the value and necessity of his services in the sick-room. But these services have been rendered almost exclusively to well-to-do patients—to those who can pay for the services of a dentist. How, then, as to the poor, who need attention in the sick-room even more than the well-to-do, and who are practically unable to have it!

It may be said that in all sizable communities there is a free medical attendance at the homes of the poor. This is true; but few medical men, especially in the cities, understand affections of the teeth, and know how to treat them. As a result, physicians generally avoid interfering with dental affections, or treat them in an unsatisfactory and sometimes in an unjustifiable manner. What is needed is a skilful dentist who will attend such cases and give them the same treatment which the prosperous part of the community can command. Supposing that we grant the desirability and necessity for a service to the sick poor, the question promptly arises: How can it be furnished? The suggestions which I shall make as to the practical side of this question are the result of my endeavors during the past six years to furnish a service to the sick poor in connection with the infirmary of the dental department of Harvard University.

First as to communities where dental schools are established. The dental schools should be a center for work of this kind. Let a department be organized which can be called the "out-patient department," or the "emergency corps," or by any other suitable name. Let some member of the teaching staff have the work under his control. Let him get together a number of suitable helpers, and instruct them, if necessary, in the bedside treatment of dental affections.

A suitable outfit of instruments should be selected and kept ready for use in a convenient visiting-bag or case. As to the instruments and medicines, the following have proved very useful: One universal upper root-forceps to be used on the six anterior teeth, the bicuspids, and all upper roots. One universal upper molar forceps for the three molars. One universal lower root-forceps for the six

anterior lower teeth, the bicuspids, and all lower roots. One lower universal molar forceps for the three lower molars.

With these four forceps all ordinary cases of extraction should be managed. Besides forceps there should be a boilable mouth-mirror, dressing pliers, an examination point, an all-metal boilable syringe, a root-canal broach, two or three simple excavators, two chisels for breaking down enamel, and a lancet. In order to open into a pulp-cavity in case of the death of a pulp, there should be provided a spear-pointed drill fitted to a hand mandrel. Mouth-napkins and absorbent materials will, of course, be added.

As to medicines, I should recommend carbolic acid 95 per cent.; oil of cloves and chloroform equal parts; these for relieving pain from an exposed pulp. Tincture of iodin, tincture of aconite root, chloroform, equal parts, to be used as a counter-irritant applied to gum tissue. Sandarac varnish for use on cotton as a temporary stopping.

The instruments should be arranged in a washable white linen case, and the medicines in small bottles fitted in a leather case. The linen instrument case and the leather medicine case can be conveniently carried in the visiting-bag. Too much stress cannot be laid upon the necessity of sterilization by the boiling of the entire set of instruments after each visit. After sterilization, the instruments should be put in a fresh linen case and thus made ready for the next visit. When the service has been organized, and the instruments prepared, a public announcement should be made so that the community may understand what can be expected. It will be found desirable to print small cards stating that calls to the sick poor for relief of dental affections will be promptly responded to if sent by telephone or letter to the dental school at which the service is organized. These cards should be sent to all hospitals and charitable institutions and societies in the vicinity; also to those individuals, present in every community, who work among the poor in an independent way. When once such an announcement is made, the service offered should be carefully performed. Promptness in responding to calls is of the greatest importance.

Where dental schools do not exist, the organization of a service to the sick poor is not so readily accomplished. It is, however, perfectly feasible if the local practitioners are willing to give a small fraction of their time in behalf of the public good. In such cases, let there be a meeting of all the practitioners in a given town or city. Let the year be divided up according to the number of practitioners, and let each practitioner agree to be responsible for emergency calls during his allotted fraction of the year.

These calls can be attended to after office hours, either in the late afternoon or evening, and need not seriously interfere with regular work. An outfit of instruments for general use should be provided as above described and kept at a convenient central station. The public should be duly informed as to what the dentists of the community are prepared to do.

There are two reasons why I urge the establishment of free dental service for the sick poor. In the first place, because the poor are sadly in need of such service. In the second place, because dental practitioners should, to a larger extent than is now common, give some fraction of their time in public work of a purely

charitable nature. I am well aware that every practitioner treats in his private office many deserving cases for which he asks no compensation. But the times demand a more public and systematic expenditure of free professional skill. There are many in every community who look upon the dentist merely as an eager and successful money-getter. They recognize his professional ability and are ready to purchase it. Let the dentist be known not alone for his professional ability but also for his unpaid services to the needy poor, and his standing in the community will be appreciably raised.

The next paper announced by the Chairman was by Dr. H. L. Ambler, Cleveland, Ohio, on "Care of the Teeth of the Poor," as follows:

Care of the Teeth of the Poor.

By H. L. AMBLER, D.D.S., Cleveland, Ohio.

The care of the teeth of the poor naturally begins with teaching them prophylaxis, and they must be made to understand that they can prevent some diseases of the mouth and lessen caries of the teeth. In order that the greatest benefit may be derived from dental hygiene it should be instilled into their minds somewhat as the A B C of rudimentary education—going over and over the subject until it is comprehended. Talking alone will not suffice; it should be demonstrated in our public schools by trained teachers or scientists, who should exhibit a good form of toothbrush and show the children how to use it; this demonstration should also include the use of toothpicks, floss in its several forms as found in the market, and narrow strips cut from rubber dam, which is much better and cheaper than rubber bands.

Filo silk is cheaper and stronger than floss, and it can be separated into one or more soft strands which may be waxed and used to clean the approximal surfaces of the teeth; by dividing it as above stated it can be made to pass between any teeth no matter how close together they may be. The writer has used it exclusively for thirty years when adjusting rubber dam, etc. It should be often and emphatically explained why it is important to cleanse the approximal surfaces. Every good thing has to be repeated before the public will believe it. The most simple and inexpensive dentifrices both liquid and solid should be mentioned, together with the method and frequency of using them.

"If the mouths of children in public schools could be examined by competent dentists, carious or diseased teeth filled or extracted, and instructions given and enforced with regard to the intelligent use of brushes and antiseptics, the death-rate of this country would be very materially lessened, the percentage of illness much reduced, and a stronger and more vigorous race result."

It seems as though it were the aim of those in charge of the public schools to teach nearly everything but dental hygiene. For example, there has been established in a very few cities in the United States a department of "physical

education," where the teachers devote their time to the building up of undeveloped pupils and systematic training of children actually in need of physical education. No doubt it can be shown that one cause of non-development is dental and oral disease; it follows, then, that to be successful these teachers need the assistance of the dentist.

Those who cannot be coaxed into caring for their teeth can often be driven to do so by telling them that most mouths contain myriads of micro-organisms, and that some of these micro-organisms produce caries of the teeth, besides diseases of the mouth and intestinal tract; also that particles of food in and around the teeth degenerate into fermenting and putrefying substances and gases which injure the teeth and general health and form a suitable pabulum for the development and multiplication of micro-organisms. These facts should be dwelt upon by those attending the sick poor, who may be thus induced to cleanse their mouths.

In Cleveland, Ohio, the eye inspector in the public schools is appointed by the superintendent of public instruction at a salary of two thousand dollars per year, and his duties employ all his time in examination and treatment—in fact, he is obliged to send many cases for free treatment to the dispensaries. Occasionally some benevolent person gives him money to purchase glasses for the poor, and in other cases he informs the superintendent of the city infirmary that such a child needs glasses, and if the parents are too poor to buy them the superintendent has the matter investigated, and if the parents are found to be worthy poor he gives an order on an optician for the needed glasses, which are paid for out of public money. Taking it for granted that this is the proper thing to do, why cannot poor children have their teeth cared for on a similar plan?

We must reach the parent through the child, the child through the teacher, and the teacher through a dentist paid by the municipality, or else through a text-book on physiology—and so far as the writer is aware these text-books are entirely inadequate. True, some of them are better than those of twenty years ago, but there is a great chance for improvement, and boards of health, school boards, and publishers who have the good of the commonwealth at heart should see that this matter is righted. In the Physiology used at the great Chautauqua Assembly only four pages are devoted to the teeth.

The Cleveland (Ohio) Dental Society, through its committee on hygiene and with the co-operation of Superintendent Jones, succeeded in getting a few changes and additions made to the chapter on teeth in the Physiology used in the public schools of the city.

In order to prove the dearth of matter pertaining to the teeth, the writer examined ninety-eight works on physiology, hygiene, and kindred subjects, and found that thirty-five contained nothing, sixty-three contained one hundred and three pages—an average of one and two-thirds pages per book. To the dental mind comments are unnecessary; but it would be well to publish these facts broadcast.

Medical inspection of schools is in force in fifteen cities of the United States, and dental inspection is sure to follow, as each will be of great assistance to the other, and a large number of poor can be reached in this manner. The dental inspector might be appointed by the board of health, the superintendent of schools, or the board of education. He should report twice during each

school year, and also receive pay for his time as do medical inspectors. School could begin a few minutes earlier on certain days until all pupils had been examined, and then, if the inspector were not authorized to send poor children to a dentist paid by the municipality, as is the case in some places abroad, a card might be sent to parent or guardian stating the treatment needed.

The municipality of Strasburg, Germany, has resolved to build at a cost of eight thousand dollars a dental hospital for the exclusive use of school children. Every child must be subjected to a dental examination on entering school, and twice every school year until the age of thirteen.

In many children development is interfered with by the diseased condition of the teeth, and furthermore when they suffer from toothache they cannot study and often prevent others from doing so. Dr. McCoy says, "In a school of seven hundred pupils, of 500 between ten and eighteen years of age, 50 cleaned their teeth twice a day, 275 used a brush occasionally, and 175 did not own a brush; of 200 in the primary department from six to ten years of age, not more than 10 used a brush." This gives a good idea of this open field for inspection and instruction.

A child will often bear toothache for days before saying anything about it, because he is afraid he will be sent to the dentist. Eventually he becomes incapacitated for school work before attracting the attention of the parents.

Dental hygiene has an economic value also, and if we can get poor people to understand the matter, and can contrive a means of notifying them early and officially that their children need dental services, they may be able to obtain such service free; and if not free, at but a small cost, thus leaving a small balance to be spent for something else. It is high time conservation of the teeth were attended to, as the manufacturers of artificial teeth claim their sales are increasing every year, and it is probably true that the enduring quality of the human dental apparatus in the United States has become progressively less from generation to generation. In 1900 the United States had over 26,000,000 of children of school age—between five and twenty years; over 15,000,000 of these attend school, so that there is more than plenty of work for dental inspectors. It has been estimated that 10 per cent. of public school children cannot compete with their robust mates owing to some form of disability, a portion of which is necessarily dental. During one year in Philadelphia over 5000 pupils were found requiring medical attention, and there can be no doubt that many of them were made sick through the existence of some kind of dental trouble.

Competent observers say that there exists a more or less marked ratio between the physical soundness and mental acuteness of the child and the condition of the teeth. Where inspection has been in force it has proved to be an educator of both children and parents, and has attracted the attention of school boards and health boards, in localities where there is no inspection, to the importance of oral and dental hygiene. A child who is well will learn faster and behave better than one who is ill; thus it naturally follows that the teacher has an easier task.

Inspection is a direct practical and economic method, and it must be admitted that correction of oral and dental lesions means days at school which would be lost from toothache and its many re-

flexes, such as ear-ache, eye-ache, headache, etc., and an eminent neurologist has said that "Even decayed teeth may set up nervousness of a visceral type usually erroneously considered temperamental."

If each child in the United States between five and twenty years of age loses one hour during the school year, at the end of the year there will have been lost more than 14,000 school years. Is it not reasonable to presume that 3 or 4 per cent. of this time has been lost on account of dental lesions? In a city of 50,000 school children, reports show that during one week in February 4000 were out of school on one or more days on account of some kind of sickness.

Boston, Mass., has about fifty medical inspectors, and they have formed an inspectors' association which is presided over by the chairman of the board of health, and from time to time they listen to addresses by specialists on diseases of the eye, ear, nose, throat, etc., in addition to their other work. When we have dental inspectors, they might adopt a similar plan. In Paris, France, both medical and sanitary inspection are obligatory in public and private schools, and by virtue of an act of the municipal council the pupils of the public schools have their teeth examined every six months, and many of these children obtain free services at the dental colleges. Hygiene is considered of so much importance that Durham College of Medicine, England, proposes to confer the degree of Bachelor of Hygiene—B.Hy.—instead of the diploma in public health.

A movement is on foot to introduce into the Canadian public schools regular dental inspection of the teeth of all pupils, because the fact is recognized there that diseases of the teeth produce both moral and physical degeneracy.

Poor people always neglect their teeth and thus have caries, with pain, and finally have the teeth extracted; they also have more accidents, such as falls, blows, sickness, etc. They especially are ignorant about the teeth, and one means of education would be to distribute among them booklets (through the children) giving instructions about caring for teeth and using simple remedies and methods. They should know that bad teeth often cause bad digestion, bad digestion causes a craving for liquor, and liquor causes crime. They should know also that teeth are as valuable as ears, noses, fingers, etc.

It has been said that there was less effort to care for the teeth of the poor in the United States than in England or on the Continent. About 90 per cent. of the children of the poorer classes in the United States have diseased teeth, and Dr. Pedley reports about 75 per cent. in England. In Germany 20,000 children from six to fifteen years of age were examined, and it was found that 95 per cent. of them had dental caries. Dr. Ottofy inspected the teeth of 500 Filipino school children and concluded that their teeth do not differ materially in structure from the teeth of American, German, French, British, Swedish, or other school children of the Caucasian race. The number of school children abroad whose teeth have been examined is about 23,000, which far exceeds what has been done in the United States. Dr. Hopkins says: "It is not too much to say that 30 per cent. of all teeth of children between the ages of five and fifteen in the public schools of the United States are diseased."

In order to convince the proper au-

thorities that dental inspection is desirable, you must have plain facts accompanied by statistics to lay before them.

In 1900 the National Dental Association appointed a committee to consider the expediency of inaugurating steps looking to the co-operation of the public schools in teaching "Good teeth—good health." This committee undertook to gather statistics about dental caries and other abnormal conditions, such as hare-lip, cleft palate, V-shaped jaw, irregularities, etc. The circular sent out says: "We want children instructed in the care of the teeth and mouth—taught some system of oral hygiene. Young minds are very susceptible, and they would readily understand, if properly taught, the serious results liable to follow the neglect of their mouths and teeth. The results would be of scientific and economic value, and if you will make a systematic examination of the teeth of school children from six to fifteen years of age, blanks and diagrams will be sent at the expense of the National Dental Association." The work to be done by the examiners was to be purely philanthropic and scientific in obtaining statistics which would be of great value to the profession and public.

At the above time this movement was general in the United States and Europe. We believe that the schools in Brooklyn, N. Y., were among the first to be inspected. The mere fact that professional men were doing the work, and were doing it unselfishly, would bring the parents to appreciate the difference between professional and unprofessional dentists.

In order to introduce instruction in oral hygiene into our public schools, Dr. E. E. Haverstick of St. Louis says: "It will be necessary to amend Section No. 9958 of the Session Act of Missouri of 1901. This section relates to the branches in which teachers must pass an examination for their license to teach in the public schools. The amendment should make the law so strong on this point that a teacher who does not understand the laws of oral hygiene, and who does not know the ill results of the too early extraction or the too long retention of the temporary teeth, and who does not know that the first permanent molar belongs to the second set of teeth, and how important it is to save it, would not be permitted to enter the schoolroom to instruct children. The teacher should know the time of eruption of the permanent teeth, the anatomy of the teeth, the results from the death of an unattended tooth-pulp, that devitalized teeth often cause swellings, also how to clean the teeth, and such general things as these."

Teachers should be required to examine the teeth of their pupils as to cleanliness and soundness every week. Such a law would force all schools which prepare teachers to introduce into their instruction a course in oral hygiene and anatomy, and this would create chairs in these schools which could be filled by doctors of dental surgery only. The idea is that better results can be obtained from examinations made by trained teachers than when made by dentists, as the teachers would examine more often, they would have more influence and watch more closely.

Dr. J. P. Corley says: "Every state society should have a standing committee, one duty of which would be to memorialize its own state educational and medical associations, and to insist that every medical college within its bounds should attach to its teaching corps a lecturer on oral hygiene and dental prophylaxis, and that all public and normal

schools have some systematic instruction on the subject."

The National Dental Association at the Asheville meeting passed the following resolution: "That it is the sense of this meeting that each medical college in the United States should include in its curriculum a lectureship on oral hygiene, prophylaxis, and dental pathology." It seems to be a plain proposition that the medical colleges through their graduates, instructed in above studies, might become potent factors in caring for some of the diseased teeth of the poor. In 1825 Dr. H. H. Hayden of Baltimore, Md., delivered to the medical students of the University of Maryland some lectures on dental physiology and pathology. The medical department of Washington University, St. Louis, Mo., added a dentist to the teaching staff in 1864, and in 1868 the Homeopathic College in Cleveland, Ohio, did the same; since that time the writer has made a record of seventeen more in the United States. The report of the Commissioner of Education for December 1902 shows that there were in the United States 154 institutions granting medical degrees, with 26,821 students in attendance. Johns Hopkins University, Baltimore, Md., does not admit young women to prepare for trained nurses unless their mouths and teeth are in a healthy condition.

In the *Dental Cosmos* for January 1904, Dr. W. H. Potter gave a description of the establishment of free dental service for the sick poor at their homes, by the Harvard School, Boston, Mass., in 1897. The service was simply for the relief of pain, and was carried on by a special corps of the best students, who were given bedside clinics. These attendants did not fill teeth or make artificial dentures, but carried four pairs of forceps, dressing pliers, explorer, three excavators, two chisels, drill, broach, lance, syringe, mouth-mirror, carbolic acid, oil of cloves and chloroform equal parts, aconite, iodin, and chloroform equal parts, aseptic cotton, and sandarac varnish.

Tufts College Dental School, Boston, Mass., is working along the line indicated above, but they find that they are handicapped because there are so few men in the senior class who have passed their state board examinations. If students could go out under the direction of the chief demonstrator of the operative department the work could be greatly enlarged, and homes for old men and women, orphans, and other charitable institutions could be visited. The state makes no provision for the care of the teeth of the inmates of asylums, etc.; all the attention they receive is in the line of extracting by the house officers. For the last two years there has been a bill before the legislature in Massachusetts providing for the appointment of dentists by the governor to attend to the people in charitable institutions. Quite a number of prominent practitioners have personally gone before the legislature and indorsed the bill, and there are still hopes that it may be passed. The managers of Tufts College sent out circulars to those whom they thought would be interested in the success of the dental department, inviting them to contribute to a worthy plan by which the charitable work of the department could be carried out and enlarged.

In the United States nearly all of the charitable dental work for the poor is done by the dental colleges at their clinics or by an "emergency corps," as formerly noticed, but they only reach a small portion of the needy; they do much

good, but only begin to care for the great number of suffering ones. Perhaps one-half of those who attend the clinics can pay a very small sum, and, so far as the writer is aware, none of the colleges turn away those who cannot pay; but the calls from the latter are increasing, and the consensus of opinion among college men is that a fund should be established the interest of which could be used to purchase material for operations that must be made gratuitously. In order to establish such a fund dentists must either by talking or writing attract the attention of the wealthy and benevolent, and persuade them to endow or give outright to dental college infirmaries such sums of money or other property as their wisdom dictates. They should be shown the advantage of these opportunities and the great good that can be done for the health and consequent happiness of the poor. In the United States the laity at large do not know that dental colleges are doing any charity work; they have always known that medical colleges and hospitals cared for the worthy, and often the unworthy, poor; but the idea that dentists at college would work without fees they regard as preposterous, because they have been led to think that dentists make money very easily and as a matter of course dental colleges are becoming wealthy, and the bare idea of contributing to their charity fund never cast a glimpse of a shadow across their minds.

A free dental clinic has recently been established at the New Haven, Conn., free dispensary. The equipment was furnished by the estate of Mr. F. H. Hooker. The clinics are held Tuesdays and Thursdays from two until four, and the operators are appointed by the director, Dr. E. S. Gaylord, six months in advance, and a number have promised to give their services four half-days each month for six months, to perform all operations except gold fillings, artificial dentures, and orthodontia. The card system has been adopted so that every operation can be referred to at any future time.

The Edinburgh (Scotland) Dental Hospital—college, as we call it—is considered a public charity, to which the city council gives five hundred dollars yearly; and in addition to this, subscription papers are circulated. In the waiting-room of the old Dental Hospital of London there was a large blackboard on which appeared the names and amounts of money donated by each person; this showed that it was largely supported by voluntary contributions. In a few years these amounted to over two hundred thousand dollars, with which they erected a new building. It is a common thing to solicit money for dental colleges, and nobody takes offense, as it has always been the custom, and there are many ladies who contribute. In some cases bequests are made in wills; in others there are annual subscribers both among the laity and profession. Governors and subscribers can issue tickets to the poor, viz, every poor applicant suffering pain to have gratuitous assistance, but necessitous persons requiring special operations to be admitted on the recommendation of a governor. Patients are often required to present a special application, in which it is certified by a clergyman, minister, or justice of the peace, that the applicant is in necessitous circumstances.

His Royal Highness the Duke of York, K.G., is president of the National Dental Hospital and College of London, and among the managers are many other titled gentlemen. Every donor of one hundred dollars to this hospital becomes a life governor, and is entitled to recom-

mend twenty patients annually. Every donor of fifteen dollars annually becomes an annual governor, and entitled to the same privileges as the life governors. Every donor of fifty dollars becomes a life subscriber, and entitled to recommend ten patients annually. Every donor of ten dollars annually is entitled to recommend ten patients annually. Every donor of twenty-five dollars is entitled for life to recommend five patients annually. Every donor of five dollars annually is entitled to recommend five patients annually. Every executor, under direction in the will of a testator, who pays five hundred dollars or more shall be a life governor. Every clergyman who by a collection in his church obtains and donates twenty-five dollars shall be entitled to recommend ten patients during that year; if he donates one hundred dollars he shall be an honorary governor for five years, and if he donates two hundred dollars he shall be an honorary governor for life. In the annual announcement is published a list of donors and subscribers with the amount subscribed opposite each name. The names of seventy ladies and a greater number of gentlemen appear in the list for 1898, and the amounts vary from five to two thousand dollars.

Guy's Hospital, London, has an endowment fund exceeding one million dollars, and connected with it is a dental school. Here patients are not obliged to obtain cards of admission, but the "chief of clinics" decides whether or not they are entitled to free services; if not, they pay various small fees. On the surgical and medical staff there are three dental surgeons, and accommodations are furnished for dental patients in one of the wards; probably this is also true of a few other hospitals. In Paris, dental services are provided for in some of the hospitals, where dental students under an instructor do more or less work. Among the oldest bequests in London charities is one which provides for the care of the teeth of 2800 poor people yearly. A few years ago a bequest was made to be used to pay for the care of the teeth of school children in a village of England, in cases in which the parents could not afford to meet the expense.

If all of the above facts were widely disseminated we believe that the municipal authorities and benevolent wealthy people of the United States would soon solve the problem of "the care of the teeth of the poor."

The idea was suggested, and tried, of having dentists not connected with colleges give a certain portion of their time to the worthy poor who cannot leave home; but so far as we know the movement has not grown much, because there is more or less apathy in the profession and it needs someone to take charge of the matter and make it known to the public in some way, and also headquarters where calls could be sent for services, with someone stationed there to notify the dentist who is on duty for that day; if he cannot go, then the one at headquarters should find a substitute. Most dentists are willing to do a certain amount of charity work, but when they find that their services are not appreciated they soon lose interest.

The board of directors in every general hospital should be thoroughly impressed with the fact that some of the inmates are suffering from dental lesions nearly all the time, and that it is their province to have them relieved just the same as if they were suffering from a lesion of any other part of the body. The way to accomplish it is to have a room in the

hospital furnished with a dental chair and a case containing sufficient medicaments, materials, and instruments to treat oral and dental diseases and fill teeth with plastics; also included in this outfit should be forceps, etc., for extractions. One or more dentists should be formally appointed on the staff of every hospital and one or more beds should be assigned for serious dental cases; thus the dentist is placed in a proper light—on an equal footing with other medical men on the staff. No doubt the general practitioner and surgeon would often gladly send some of his perplexing cases to the dental surgeon.

The time is near at hand when all first-class hospitals will feel the necessity of, and adopt a system similar to that outlined above, in order to keep step with the progress of the times. The writer already has a record of twelve (probably there are more) large and small hospitals in the United States which have a dentist on the staff, and so far as he knows, Chicago leads in this respect. If the accommodations and conditions were such as outlined, there would be no difficulty in getting dentists to give a portion of their time to the care of the teeth of the poor in hospitals.

The laws of the different states should make it possible for the governor or the board of health to appoint, with salary affixed, a resident dentist for blind, deaf and dumb, epileptic, and insane asylums There are very few such appointments in the United States—perhaps six or eight would cover them all.

Every dentist is aware that people have become insane, and some of them kept so, from dental diseases, and in the case of epileptics very many have been greatly relieved by the dentist. A room in each asylum should be furnished, as above suggested, and the patients cared for by a dentist. Very little attention has been given to this method of caring for the teeth of the poor and helpless, because politics is the great absorbing theme, and the facts concerning dental lesions among the poor, and showing the necessity for remedial measures, have not been sufficiently and emphatically called to the attention of those having the appointing power.

Another way to care for the teeth of the poor is to interest the management of homes for orphans, old men, and old women, of boys' and girls' industrial homes, etc., which are dependent upon charity. By often sending them booklets on hygiene, etc., they will become interested, and finally will secure a dentist, or dentists, willing to do some charitable work by giving instruction or operating.

You must educate the poor in dental hygiene or they will neither care for their teeth, nor will they ask or even allow the dentist to do so; and a most potent power for getting at them is the daily press. Societies should choose members to write short intelligent non-technical articles, perhaps once a month, and, if thought best, these articles could be read before the society or submitted to the publishing committee before being printed without any signature. Another way of reaching the people is through popular magazines. A few years ago the *Cosmopolitan* offered a cash prize of two hundred dollars for the best article on "Care and Preservation of the Teeth"; a number of essays were sent in, the prize was awarded and paid, and the essay published. *How to Live*, for April 1904, presented an article on dental hygiene covering thirteen pages—three or four times as much as is contained in many text-books on physiology or hygiene. The

article was rather unique and attracted the general reader, as it was illustrated.

In 1896 a manufacturing company at Yonkers, N. Y., undertook somewhat of an educational campaign by offering the sum of four hundred dollars, divided into four prizes, for the best original article on "Germicides and Antiseptics in Dentistry." The articles written by dentists were published and the prizes paid, and in the furthering of prophylaxis, etc., they accomplished much good. The Swedish Dental Society, Stockholm, offers $185 for the first prize, and $80 for the second prize, for the best essay on "The Teeth and Their Care." The essay is intended for free distribution among school children and the lower classes of people.

Discussion.

Dr. J. Y. Crawford, Nashville, Tenn. I have been attending dental societies for twenty-two years, and I never heard so important a paper as this one.

These things should be impressed on children. A young man, a student under me, came to me from the country and said he had been asked to examine the teeth of the children; he wanted my advice. I asked if this had come to him unsolicited, and he said it had. I asked if he would get any pay for it. He said he would not. I told him then by all means to do it.

I believe I was the first to get a chair of prophylactic dentistry and oral hygiene in the schools. This idea of trying to segregate the treatment of the oral cavity from the rest of medical science is rushing against intelligent public sentiment. If there is any one thing I would rather do for the good of the people, it would be to put into the medical schools of this country a chair of oral surgery.

Dr. E. B. Lodge, Cleveland, O. I am glad to have had the opportunity of hearing this paper of Dr. Ambler. I know he has gone to the root of this question, and has studied the institutions abroad, and I feel he is most competent to make this outline of what may be done and should be done in our public institutions. This is a subject that demands the attention of all dentists. A start has been made in Cleveland in this direction, and much good work has been done, but more remains to be done.

Dr. Louis Ottofy, Manila, P. I. This valuable contribution of Dr. Ambler agrees perfectly with what I advocated in the paper I read before this section, and furthermore the subject is ably supported by facts and statistics which will be of great value in securing dental services for the poor. The principal disadvantage has been that we had no facts to present, and those in authority cannot be made to fully understand the importance of the matter. I remember when I endeavored to secure permission to examine the school children's teeth in the public schools of Chicago, that it was some time before the authority was granted. It was impossible at that time to present data to convince the school authorities of the benefits that may be derived from this work.

Dr. C. W. Rodgers, Boston, Mass. The chairman of our committee on oral hygiene at the meeting of the National Dental Association last year quoted from Webster as follows: "Anything we wish to see introduced into the life of the public should first be introduced into the public schools."

A gentleman in Boston has been attending, without remuneration, to the teeth of the poor for the past seven years. Much illness prevailed before the establishment of the dental service, but the statistics now show that disease has decreased from year to year as the condition of the teeth improved. The proportion was probably as much as 500 per cent. in reduction. That is the kind of statistics we must have to present to boards of education. They will then look on it in the light of a business proposition—that it will pay to have dentists connected with the public schools. I think if some such institution as this would take action, appoint a chairman in each city, and in each state a committee of oral hygiene with authority through the National Dental Association, it would not then be thought that dentists were actuated by selfish motives. Harvard University has an emergency corps, and they have certainly accomplished a great deal of good. I do not think the state boards would interfere in any way, or require certificates to do this work.

Dr. C. R. Taylor, Streator, Ill. It seems to me we can go about helping the worthy poor in institutions, etc., in an impersonal way. Let us organize where we have our local societies, and let us work free of charge in the hospitals of the community. It has been in my mind for the past few weeks to bring this before the Good Fellowship Club of Streator, and see if we cannot unite in this work. Bacon said that every man owes a duty to his profession. Yes, and also, I add, to the community in which he resides. If he contributes something with the idea of special benefit to himself, he has hardly reached the ideal. The longer I live, the more it seems to me the object of life is to be worthy of the esteem and gratitude of the people with whom I come in contact. It is not necessary for us to look for compensation—those things will come to us; let us be worthy.

Dr. Ambler (closing the discussion). I will simply say that I appreciate the kind words that the paper has received. It is not entirely original, but many of the ideas I have never seen published; they tell how to get at the matter practically and suggest what can be done.

The subject was passed and the meeting adjourned.

SECTION IV—Continued.

THIRD DAY—Thursday, September 1st.

The section was called to order at 2 o'clock Thursday, September 1st, Dr. Peck in the chair.

After the reading of the minutes of previous session by Dr. Reid, secretary, The Chairman announced the first order of business as a paper on "The Solvent Action of Saliva on Cements," by Dr. J. E. Hinkins, Chicago, Ill., as follows:

The Solvent Action of Saliva on Cements.

By J. E. HINKINS, D.D.S., Chicago, Ill.

In a paper read before the International Dental Congress in Paris, in August 1900, the first report of a series of researches on the cause of the disintegration of cement fillings was presented. In that communication (see *Dental Cosmos*, June 1901) the speaker, in conjunction with Dr. S. F. Acree, pointed out the rôle that bacterial decompositions of the foodstuffs, with attendant production of acids, must play in the failure of cement fillings. It was found that certain bacteria generally present in the mouth, such as the bacillus coli communis, the staphylococcus pyogenes aureus, the sarcina lutea and others, decompose foodstuffs and generate organic acids.

Not only was the nature of these acids determined, but also the amount; it was found in addition that they were formed in sufficient quantity to dissolve readily several of the zinc phosphate cements which are daily used by dentists all over the world. Such cements as those of Ames, Justi, and Weston, and Harvard cement, were not able to withstand the solvent action of the organic acids produced by these common mouth bacteria. By actual experiment it was demonstrated that a sample of Justi cement in finely powdered condition was dissolved to the extent of 12 per cent. of its weight when treated for forty-eight hours with one of the above acid solutions. A sample of Ames' cement lost 16 per cent. in forty-eight hours, and a sample of Weston's cement lost 6 per cent. in seventeen hours. Of course, a sample of solid cement, such as a cement filling in the

tooth, would have only a small amount of surface exposed, and this solvent action by acids would be decreased manyfold.

In the failure of cement fillings, and also of the tooth-structure, there are two very important factors. First, the mechanical grinding away, due to friction, as in chewing foodstuffs. Second, the solvent action of the acid saliva. That the second cause is very often the more important is evidenced in many cases by the more rapid disappearance of the cement filling and of the tooth under the margin of the gum, and in other small pockets or cavities where foodstuffs and bacteria can collect. In such pockets the bacteria generate organic acids, which not being easily washed out by the saliva become more and more concentrated, and consequently dissolve away the cement filling and the tooth far more readily.

We believe that the formation of cavities in general is due to this same cause. As is well known, cavities in teeth are generally formed in places which are comparatively inaccessible to ordinary methods of cleansing. Foodstuffs and bacteria collect at such places, and the process of dissolving out the cement begins. As the cavity becomes deeper it becomes more and more difficult to remove the cause of the trouble, and consequently the cavity spreads. The only remedy, then, is to remove all the infected portion and build up the tooth to its original contour by means of some filling material.

The following table gives the amount of acids formed by the above bacteria in various solutions of foodstuffs, the time required and the medium also being added:

Bacillus.	Solution (5 cc. used.)	Time.	Strength in N/10 alkali.
1. Bac. acid. lact.	Peptone	10 days	1.70 cc.
2. Staph. pyog. aur.	"	9 "	1.30 "
3. Sarcin. lutea	"	9 "	1.75 "
4. Sarcin. aur.	"	8 "	1.60 "
5. Bac. coli com.	"	8 "	1.70 "
6. Bac. acid. lact.	"	20 "	6.40 "
7. Sarcin. lutea	"	16 "	3.00 "
8. Bac. acid. lact.	Asparagin	7 "	1.75 "

The amount of acid generated in the above solutions is comparatively small. If reckoned as acetic acid the solutions would contain on an average about $\frac{1}{5}$ of one per cent. acid. It might seem that such a very weak acid solution could not dissolve the cements or the tooth-structure to any appreciable extent, but we must remember that these acids are always present in the mouth, being constantly replenished by the flow of the saliva. Even though the acidity be small, it is yet found to be strong enough to dissolve our ordinary cements.

The above outline is about the extent of the research work that was presented to you in the first paper. A continuation of our original investigations has now shown that there are other very important factors in the failure of cement fillings and of tooth-structure. Indeed, some of these may be even more important than the bacterial decompositions. As the most important of these we wish to bring to your attention the action of enzymes and enzyme-like bodies.

ACTION OF ENZYMES AND ENZYME-LIKE BODIES.

There are many cases of failure of cement fillings and of tooth-structure in which bacterial decompositions can play only a minor rôle. You have all, without doubt, had many cases under your personal observation in which erosion of

the tooth-structure and of cement, amalgam, and gold fillings—and even of ivory artificial teeth—has been very marked. Such cases generally occur in persons past middle life, and who take excellent care of their teeth. This erosion may manifest itself in some cases only at the margin of the gum, but in other instances the erosion may extend over nearly the entire tooth-surface. Furthermore, these changes are not limited to the anterior teeth, but extend to the bicuspids and molars.

These erosions we now believe to be due to the solvent action of the secretions of the mucous membrane and salivary glands of the mouth, in cases in which from constitutional causes these secretions become especially acid (or alkaline). It is very likely that there are certain lines of flow of the saliva in the mouth—channels through which the saliva flows most easily after excretion and during its movement in the mouth—and the erosion will naturally be more marked on teeth situated in such places. We believe that the activity of the various enzymes present in the body is most intimately connected with the character of all the secretions and excretions.

When we consider the saliva, the pancreatic juice, and the other secretions of the body, we find that each contains certain enzymes or ferments. The saliva contains ptyalin and glucase. Heretofore the ptyalin has been thought to accomplish simply the liquefaction of the starch—a conversion of the starch into dextrin, and finally, with the aid of the glucase, into glucose. The secretion of the stomach contains pepsin and rennin. The pancreatic juice contains pancreatin, steapsin, and trypsin. Each one of these enzymes plays a very important part in the decomposition of foodstuffs into simpler products that can be taken up by the blood and carried to different parts of the body, there to undergo other reactions and combinations into products that then make up the component parts of our systems.

The chief products of these enzymotic decompositions of fats and albumins are *organic acids*. Among these (Hammerstein, 1899, p. 135, etc.) must be mentioned uric acid, leucin, xanthin, caffein, lactic acid, asparaginic acid, carbolic acid, phenyl-propionic acid, paracresol, phenyl-acetic acid, volatile fatty acids, and many amido acids. These acids constitute a great part of the digested food that is thrown into the blood, to be carried over the whole body, and many of them have been isolated from the blood. Further investigations will doubtless reveal the presence of many other similar acids. The great difficulty in studying such decompositions of albuminous substances—the difficulty of isolating and identifying the individual constituents—has been clearly emphasized by Emile Fischer, the savant who stands alone in the study of peptone and albuminous substances.

The saliva receives its share of these acids even under normal conditions. It has been shown (Hammerstein, 1899, p. 252, etc.) that nuclein, leucin, xanthin, and many volatile fatty acids, together with acid phosphates and bicarbonates, are present in small amount in normal saliva. The amounts of these organic acids probably vary with change of health and change in age, and certainly vary greatly among individuals. When we consider that in abnormal constitutional conditions this amount may be greatly increased, it is not surprising that such erosions are more marked in some individuals than in others.

So far as examined, it has been proved by actual experiments that the acidity of the saliva of individuals with marked erosion of the teeth is much greater than that of individuals not so affected.

History of Cases under Investigation.

	Acidity (of 10 cc. in cc. N/10 KOH).
1. Saliva of Dr. F. (42 yrs.), no erosion	0.34
2. Saliva of Dr. A. (28 yrs.), slight erosion	0.70
3. Saliva of Mrs. H. (52 yrs.), decided erosion 12 yrs.	1.32
4. Saliva of Dr. H. (46 yrs.), decided erosion 2 yrs.	1.40
5. Saliva of Mr. G. (62 yrs.), very decided erosion 3 yrs., now extending from molar to molar	1.94

The rôle of the ptyalin in the generation of these organic acids must be very important. When we consider that we have a large number of acid derivatives —substances that by hydrolysis can give rise to acids—in the saliva, and when we remember that these can be hydrolyzed by the enzymes, we see at once the possibility of having the saliva become acid. When from *constitutional causes* the enzymes become specially active and generate larger quantities of acid than usual, if there are present no counteracting influences tending to neutralize this acidity, we must expect not only the saliva to become specially acid, but also many other secretions of our systems. This would doubtless account for the excess of uric acid, of xanthin bodies, and others that give rise to gout, rheumatism, and other ailments.

Up to within the last few years not much was done to clear up the nature of these enzymes and the course of the chemical reactions which they are able to bring about. The very nature of the enzymes themselves and the difficulty of obtaining them pure was the most serious hindrance to the exact study of their properties. These enzymes are organic compounds themselves, not very stable toward heat, acids, and other influences, and for a long time the only experiments with them were really only qualitative experiments with the impure substances. There was consequently much doubt about the real action of these enzymes in the system. We were certain that the enzymes and other agents together produced certain chemical changes that constitute the metabolism of foodstuffs in our systems; but until we could separate these various agencies and show the exact part played by each, we could not be certain that the enzymes play certain rôles. These doubts are being rapidly removed. A large number of enzymes, such as ptyalin, diastase, pancreatin, emulsin, maltase, and many others, some of which are very important agencies in our digestive processes, have been prepared in comparatively a pure state, and are being studied carefully. Especially are the chemical reactions which these enzymes are able to induce being studied exactly—quantitatively. A short *résumé* of some of the more important parts of the work would not be without interest.

As is well known, the yeast plant, *Saccharomyces cerevisiæ*, converts glucose into alcohol and carbon dioxid. It was thought by many that in this chemical process the yeast plant used the glucose for food, and that the alcohol and carbon dioxid were waste products from the plant. Buchner (*Ber. d. deutsch. Chem.-Ges.*, 30 u. 31 Buchner u. Rapp. *ibid.*, 31), however, showed that when a quantity of yeast is ground up so that the cell walls are crushed, and the mixture is filtered through a filter made of porous porcelain so that no yeast cells

can pass, this liquid filtrate, which he called zymase, still has the power to change glucose into alcohol and carbon dioxid. The activity of this zymase is not destroyed or diminished by small amounts of chloroform, sodium arsenite, or glycerin, whereas the functions of the yeast itself are hindered or completely stopped by these reagents. Here we have chemical changes wrought by organic compounds, enzymes, the activity of which is not dependent upon the life of the plant with which this enzyme was associated. Just as in our living body the ptyalin, pancreatin, and other enzymes carry on their functions, so in the yeast plant the zymase effects the fermentation of glucose into alcohol and carbon dioxid entirely independent of the life-process of the yeast plant itself.

We have known for some time that in the pancreatic juice there are probably one or more fat-splitting enzymes. Whether this action is due to the pancreatin or to the steapsin, or to both of these in connection with other agencies, was not certain. Recently, Kastle (*American Chemical Journal*, xxiv, p. 491) and Loevenhardt have shown that the pancreas extract—lipase—not only can hydrolyze fats into stearic acid and glycerin, but can also decompose much simpler esters—the ethyl ether of butyric acid, for instance, into butyric acid and ethyl alcohol.

The writer and Dr. S. F. Acree (*American Chemical Journal*, xxviii, p. 370) have shown that pancreatin can hydrolyze a triacetyl-glucose-peptone solution into glucose and acetic acid, and the exact amounts of acetic acid formed in varying times were quantitatively measured.

It has been proved, therefore, by these experiments that the pancreatin can exert its normal function on foodstuffs outside of the body, and independently of other life-functions of the body.

In a recent study of the actions of enzymes on certain foodstuffs, the essayist (*American Chemical Journal*, xxviii, p. 370) in conjunction with Dr. S. F. Acree has gone into still other problems in connection with the enzymes. Not only have we investigated the activities of a number of pure enzymes and measured quantitatively the amounts of acids which these enzymes can produce, but we have also investigated the following very important problem:

In considering the varied foodstuffs in their course through the digestive process, it has heretofore always been assumed that each particular kind of foodstuff—fat, starch, albumin—is acted on by only one particular enzyme; for example, the ptyalin acts upon the starch, the pepsin upon albumin, etc. On the other hand, we suspected that there may be some classes of foodstuffs which will be acted upon by every enzyme in the digestive system—by some to a large extent, of course, and by others not so much. To test this hypothesis we subjected triacetyl glucose to the action of a large number of enzymes. Among this number were ptyalin, pepsin, pancreatin, and emulsin, all enzymes occurring in our bodies. Every enzyme examined was able to hydrolyze triacetyl glucose into acetic acid and glucose. Pancreatin and ptyalin were very active, while others like emulsin and diastase were not so active. So we feel safe in assuming that while each ferment in the body has certain functions which it can best perform, yet it may be concerned in still other reactions in a minor way.

In order to show you the varying activity of different enzymes, we present

a short table of the determinations of the acidity produced by different enzymes when acting upon a triacetyl glucose which was at first N/42.50 acid:

Enzyme.	Time.	Strength of acid solution.
Pancreatin	10 days	N/21
Amylopsin	10 "	N/25
Emulsin	11 "	N/40.5
Maltase	14 "	N/22.2
Diastase	12 "	N/33
Takadiastase	7 "	N/27

From the above discussion it is clear that the rôle of the enzymes in our life-processes must be very important. The foods are digested by enzymes, the various organic acids are produced and are taken up by the blood and given out to some extent in the secretions—one of the important ones being the saliva. The saliva has several organic acids in it. When from constitutional causes this acid becomes excessive, the teeth and fillings are far more likely to be dissolved away. In order to establish a definite connection between the activity of the enzymes and the failure of cements, we instituted the following experiments: A neutral peptone solution of triacetyl glucose* was subjected to the action of pancreatin and ptyalin. The acidity increased regularly and was measured from time to time, as the following tables indicate:

Ptyalin Solution.

Time.	N/10 KOH required for 10 cc. solution.	N/10 KOH required for original triacetyl glucose solution.
0 days	0.00 cc.	2.50 cc.
5 "	7.50 "	3.00 "
9 "	8.50 "	3.50 "
17 "	11.00 "	4.00 "
26 "	13.00 "	4.60 "
32 "	13.90 "	4.75 "
(Enzyme filtered out.)		
40 days	13.75 cc.	5.50 cc.
47 "	13.75 "	5.60 "

Pancreatin Solution.

Time.	N/10 KOH required for 10 cc. solution.	N/10 KOH required for triacetyl glucose solution.
0 days	0.00 cc.	2.50 cc.
5 "	8.00 "	3.00 "
9 "	9.00 "	3.50 "
17 "	12.00 "	4.00 "
26 "	14.50 "	4.60 "
32 "	14.84 "	4.75 "
(Enzyme filtered out.)		
40 days	14.75 cc.	5.50 cc.
47 "	14.50 "	5.60 "

These solutions were filtered from the enzyme, and they then much resembled bacteria-free saliva in composition, differing only in being a little more acid. To ascertain whether these solutions could dissolve cement fillings, we treated samples of the solutions with pellets of cement which had been made as usual for fillings and had set, and with the finely-powdered cement obtained by grinding up some of the pellets. The solutions were allowed to stand several days in an ice-box, and the loss in weight of the cement was then determined. The following tables show the quantitative data:

Ptyalin Solution.

Time.	Ptyalin solution.	Weight of cement.	Loss.
0 days	50 cc.	0.6793 gm. (pellet)	
8 "	50 "	0.6505 " "	
		———	0.0288 gm.
0 "	50 "	1.000 gm. (powd.)	
8 "	50 "	0.927 " "	
		———	0.0730 "

* Glucose 40 gm. and acetic anhydrid 120 gm. were heated on a water-bath for half an hour, to dissolve the glucose. The solution was then poured into 250 cc. of hot water, evaporated to about one-third of its volume in three hours, neutralized with N/KOH solution, and diluted to 1 liter. Then 250 cc. of this solution + 50 cc. of 1 per cent. bouillon, were treated with 5 gm. of ptyalin or pancreatin. The solutions were kept in an ice-box, and a check was also kept on the original triacetyl glucose solution.

Pancreatin Solution.

Time.	Pancreatin solution.	Weight of cement.	Loss.
0 days	50 cc.	0.5767 gm. (pellet)	
8 "	50 "	0.5400 " "	
		———	0.0367 gm.
0 "	50 "	1.000 gm. (powd.)	
8 "	50 "	0.860 " "	
		———	0.140 "

It is very evident from the above tables that our solutions made aeid by enzymes ean readily dissolve the eement. It is to be noted that the solid pellet dissolved much more slowly than the powdered eement, due to the much smaller surfaee exposed. The erosion of the pellet would approaeh more nearly that of the filling *in situ*. As seen above, the acidity of very acid salivas is very much smaller than that of these two enzyme solutions, and eonsequently the eement fillings in the teeth would be eroded more slowly. But the differenee would be one of degree only. We wish espeeially to call your attention to the faet that the above tables show decisively that the more acid solution dissolves the eement more rapidly.

In order to learn the eombined effeet of baeteria and enzymes together on a foodstuff solution like peptone-triaeetyl-glueose solution, we tested eaeh of the foregoing pancreatin and ptyalin solutions with eultures of baeteria taken from the mouths of individuals presenting severe eases of erosion. Since in the mouth there are generally present enzymes and bacteria together, sueh eonditions are most nearly realized in these solutions. The solutions were kept at 37° C., *i.e.* the body temperature, and titrated from time to time.

It will be seen from the tables following that even in a shorter time the presenee of the baeteria eauses a rise in aeidity:

Ptyalin-bouillon-triacetyl-glucose Solution at 37°.

Time.	Acidity of 10 cc. expressed in N/10 KOH.
6 days	9.50 cc. N/10 KOH
14 "	12.00 " " "
21 "	13.75 " " "

Pancreatin-bouillon-triacetyl-glucose Solution at 37°.

Time.	Acidity of 10 cc. expressed in N/10 KOH.
6 days	11.25 cc. N/10 KOH
14 "	16.50 " " "
21 "	19.00 " " "

After these two solutions had been standing fourteen days, 50 cc. of eaeh solution was allowed to act upon a pellet and on powdered cement for one week. The following tables will show the amount of eement dissolved. It is to be noted that the powdered cement was mueh more readily dissolved than the pellet. Again it must be noted that sinee these solutions are more aeid than the saliva, and since the cements are more exposed to the action of the aeid, the amount dissolved is many-fold what it would be in a eement filling. The difference, however, is one of degree only:

Ptyalin-bacteria Solution.

Time.	Solution.	Weight of cement.	Loss.
0 days	50 cc.	1.000 gm. (powd.)	
7 "	50 "	0.825 " "	
		———	0.175 gm.
0 "	50 "	0.2618 gm. (pellet)	
7 "	50 "	0.2255 " "	
		———	0.0363 "

Pancreatin-bacteria Solution.

Time.	Solution.	Weight of cement.	Loss.
0 days	50 cc.	1.0000 gm. (powd.)	
7 "	50 "	0.7430 " "	
		———	0.257 gm.
0 "	50 "	0.2608 gm. (pellet)	
7 "	50 "	0.2080 " "	
		———	0.0528 "

These quantitative data show beyond question that the more acid solution dissolves the cement more rapidly. It will be recalled that it was shown four years ago that of those solutions made acid by bacterial decompositions, the more acid solutions dissolve cements more readily than those not so acid.

CONCLUSIONS.

The subject of failure of cement fillings and tooth-structure is the most vital one to the dental profession; for this reason many of our colleagues have given the matter their attention, with the view of learning the causes and conditions attending such failures. The only objection that we find with the papers presented is that the writers have put forward too many hypotheses without verifying them experimentally, while the subject is one that can be cleared up only by a great amount of experimental investigation, keeping in view all the conditions that may exist in the mouth and human system; and we fear that no amount of theoretical speculation or *a priori* reasoning will be of much assistance.

In a paper by Dr. E. C. Kirk (*Items of Interest*, N. Y., July 1902) the theory is discussed that erosions may be due to the action of lactic acid and the acid phosphates of sodium and calcium upon the tooth-structure. We wish to point out that in our paper read in Paris, in 1900, we pointed out the rôle played by these organic acids in the failure of cements and tooth-structure—and in view of this, Dr. Kirk's hypothesis is not new; not only this, but Dr. Kirk did not make reference to our paper on this subject, and therefore failed to give us the credit due.

Dr. Kirk dialyzed saliva and obtained crystals from this liquid which he thought to be lactates or lacto-phosphates. We do not feel that reliable conclusions can be drawn from such data. There are many thousand different substances with the same crystal form. Unless these crystals are isolated and subjected to a chemical analysis—which Dr. Kirk apparently did not make—one can draw no conclusions in regard to their chemical composition. Aside from this, it has been known for some time that calcium acid phosphate is a normal constituent of the saliva, and that lactic acid is formed by bacterial agencies in the mouth. The presence of these lacto-phosphates does not, therefore, prove that they arise from tooth-erosion.

Michaels (*Dental Cosmos*, 1901, vol. xliii, p. 719) has shown that a dilute solution of potassium sulfocyanid can dissolve away the tooth-structure. This result has also been corroborated recently by Young and Hurst (*Journal of the American Chemical Society*, 1904, p. 885), who have shown that calcium phosphate is dissolved to a small extent by potassium nitrate and by sodium chlorid, with the attendant production of acids. This result of Michaels is very important, because potassium sulfocyanid is an important constituent of the saliva.

Dr. W. D. Miller (*Dental Cosmos*, March 1904) of Berlin, has recently put forward the mechanical theory of erosion again, and has cited several instances of erosion that have come under his observation. While not doubting the part played by mechanical erosion, to which also we have always called attention, we feel that this is not the chief cause of erosion. If this were so we should expect to find erosion prevalent among all classes who use tooth-brushes, which is

not the case. Erosion is most common among people with very acid saliva; and here we wish to point out that Dr. Miller apparently did not determine that the cases under his observation were not caused by this agency.

Many other papers have been read before the dental profession on this subject, but few of them have presented experimental work to verify their hypotheses, and will not be considered here.

From the experimental results presented above we feel that there are two prime causes to be considered in the failure of cement fillings and tooth-structure: First, a loss due to mechanical factors; second, a loss due to the solvent action of the saliva or of acids produced by bacteria. It is believed that in the formation of cavities the bacterial agencies are the chief ones to be considered. Bacteria and foodstuffs collect in inaccessible places and organic acids are produced. These act upon the cement fillings or tooth-structure and dissolve them out; as the cavity becomes deeper, the destructive agencies become less and less easily removed, and the decay becomes deeper. In order to stop the destruction the cavity must be thoroughly cleaned and freed from bacteria and filled with some filling material, left to the judgment of the operator.

There are still other agencies, however, that must be taken into consideration. In cases of general erosion of the tooth-structure the bacterial agencies cannot be the main feature to be considered. Under these conditions there must be abnormal constitutional causes. We offer the suggestion that under these abnormal conditions there is an increased activity of the digestive agencies—the enzymes, ptyalin, pepsin, pancreatin, emulsin, etc. —with an increase in the amount of acids thrown into the blood. These are transmitted to some extent to the secretions. As a result we find the saliva generally very acid. This acid saliva causes the constant erosion of the cements and tooth-structure. We have shown experimentally that in cases of erosion the saliva is abnormally acid. It has been proved experimentally that these digestive enzymes produce acids in large quantity; and, finally, it has been shown that these acid enzyme solutions resembling the saliva very readily dissolve out the cement fillings. These results connect the various links needed in the chain of evidence, and we feel that the activity of the enzymes is one of the most important factors in the failure of cement fillings and tooth-structure.

Discussion.

Dr. A. W. Harlan, New York, N. Y. The length of this paper and the enormous tables that it contains preclude the possibility of taking it up as a whole, for the reason that it would require a great deal more time than I have been able to give it, although I have read it since I have been here. The conclusions, and the disagreement in the conclusions with the work of Drs. Kirk and Miller, it seems to me can be answered by Dr. Miller, who is present. One of the practical observations I would make in regard to the failure of cement through the solvent action of the saliva, is that cement is not put into the mouth at a uniform temperature nor with a definite time for solidifying, and we have different results with reference to the capacity of that cement to remain in the teeth. We must take into consideration the personal equation. One

man puts a cement filling in a tooth without the rubber dam, and another has the dam in place. In one case it is removed as soon as the crystallization begins, and another man protects it with the rubber dam for hours to prevent various deleterious agents from coming into contact with it; and so, unless all the experiments are made with the same degree of accuracy, we are not able to determine positively the rôle the saliva plays in the destruction of cement. And furthermore, the attrition of mastication, and the movements of the jaws, due to intestinal troubles and nervous troubles, play quite an important part, which is not estimated, in the wearing down of the fillings. A man or woman fifty years of age, where the occlusion is bad, will have the teeth continually grinding and working, and will be making movements with the tongue and lips which will cause an abnormal flow of acid saliva, and so we have a still further solution of the cement fillings. In consequence of my imperfect knowledge of chemistry I am not able to follow the whole paper, but the conclusions appear to be a decided step in advance, because previous to a few years ago no work in this line had been presented, and the work of Drs. Acree and Hinkins presented in Paris in 1900, and before the Odontological Society of New York, opened up the field of experiment; and I think the essayist should be complimented for the time and labor spent in order to present the subject in so concise and clear a manner, even though it be discovered during the process of the discussion that some of the points are not well taken.

Dr. W. D. Miller, Berlin, Germany. The paper of Dr. Hinkins shows an immense amount of thorough and careful study and experiment. I am struck with the idea that theories of dental caries are increasing nowadays with great rapidity. In recent years a theory has been advocated to the effect that the bacteria of the mouth produce a ferment analogous to trypsin, which acts upon tooth-structure in the presence of alkalis, and that in consequence acids are not necessary for the production of caries. More recently Lohmann came out with his theory that the mucin normally present in the saliva is the primary cause of caries. Now Dr. Hinkins offers us a theory to the effect that the physiological secretions of the body are in a condition to destroy structures of that body. As has already been pointed out by Birgfeld, this does not seem to me a logical conclusion. It would be surprising to me if nature had done so bad a job as to make herself destructive of her own body substance. It would be as though we held that the pepsin of the gastric juice destroyed the mucous lining of the stomach, etc. It seems to me that in the process of evolution a thing of this kind would have been done away with long ago. It is a question for experimentation to determine, and the question I would like to ask Dr. Hinkins is whether ptyalin really has the property in the mouth of producing acids by which it can attack the teeth. The experiments are very interesting, but as he says, they do not really prove that this process takes place in the mouth. I would suggest that saliva be filtered through a Chamberland filter in order to free it of bacteria, and then allow it to act on foodstuffs which have been sterilized, and see if he could produce acids. If so, it would be a step gained in the demonstration of this problem. Until then I should not consider the proposition as proved; but I do not wish to detract from the great value and interest

of the experiments Dr. Hinkins has made.

Dr. Hinkins made a reference to my work on erosion to which I have no objection except that he did not exactly represent what I have put forth. He said that I bring forward again the mechanical theory. That is true, but I also said that it is possible there may be other substances besides acids which act to bring about erosion. I have hesitated to accept the acid theory, because authorities differ. We have such men as Preiswerk, Dill, and others who are in authority among us, and they claim that erosion is most frequent when the saliva has an alkaline reaction. If erosion be caused by acids, I cannot understand how it is that we have the bright, shining surface. You cannot produce a shining surface by the action of acids on tooth-substance. If you act upon enamel by an acid and brush it with a brush, the surface on drying will appear chalky. For this reason I have not quite been able to accept the theory of acid having a prominent part in the production of erosion. I would like to call the attention of Dr. Hinkins to the fact that many years ago some dentists in Germany stated that erosion was due to the destruction of the tooth-substance by a certain ferment in the mouth. Another point: I examined at one time the teeth in a large number of skulls in the Anatomical Museum of Berlin, and I found not a single case of erosion among all the skulls that were from uncivilized peoples who do not use a brush.

Dr. Kirk was criticized for not giving Dr. Hinkins due credit. There must be some misunderstanding here, as we all know Dr. Kirk to be a just author, and I am sure if his attention were called to any oversight he would be the first to correct it. Regarding the crystallization of calcium lactate, etc., he showed me his preparations. Calcium lactate crystals and those that he had studied under the microscope were identical.

Dr. Hinkins. Can you draw a definite conclusion from the microscope? There is a difference between the dead cell prepared in the laboratory and the live cell. It is a higher form of cell life, which cannot be produced in the laboratory, but which exists in the human body.

Dr. Miller. We were only determining a chemical substance. Dr. Kirk declared it to be calcium lactate, and I think he was right. In regard to the action of life and death, it would take us too long to discuss that question. One and the same cell may have two different actions and functions, one by virtue of the life that is in it and one by virtue of certain chemical substances which it produces. Take for example the phagocyte. Only the living phagocyte can find its way to the point where an invasion of bacteria has taken place, and only the living phagocyte can envelop the bacteria. The dead phagocyte, however, may prove just as fatal to bacteria, in that on breaking down it releases certain substances which have a high bactericidal power. I have looked into the action of potassium sulfocyanid upon the teeth and I have not found that a high percentage in the mouth is correspondent with extensive erosion. I would hesitate, therefore, before accepting that theory.

I wish to thank Dr. Hinkins for his paper and for the courtesy he has extended to me in inviting me to say a few words about it.

Dr. Hinkins. I want to thank Dr. Miller personally, and to say that my paper purposely was left very broad for the purpose of discussion.

Dr. G. W. Cook, Chicago, Ill. I have

been, of course, very familiar with the work of Dr. Hinkins as offered here in this paper, and not only this paper but previous ones, and I think both Dr. Hinkins and Dr. Miller have misunderstood the real import of this question. It is not so much as to whether the acid is in all instances the cause of the solution of cement and tooth-structure, but it is whether or not there is a diversion of the cell structure from which these secretions come and the extent to which they are reversible in their activity. They secrete a ptyalin easily converted into a fermentive substance itself. As to how far this physiological condition can carry on destruction is of course an important question. The absorption of the roots of teeth is a pathological process, but carried on by a physiological cell action around the tooth-root. The cells which cause this disintegration, in some instances, are diverted from their physiological function to that of destructiveness; they take on the function of eliminating certain tissues. Is it not possible that we might have an action that might destroy the tooth-substance? It might be neutral, but this has led to considerable speculation along these lines.

Some two years ago, Dr. Hinkins and his co-worker brought out the point that many of these enzymes would carry an acid reaction to a certain point, and when it reached a certain definite point it would revert and become alkaline, and in this you will find the great scale of variation of some of these organic forms. Is it not, then, possible that the physiological cells of the salivary glands, etc., might become diverted to the extent that there is not secured a perfect, normal ptyalin, and that there is a reversion or diversion into an acid or alkali without the presence of micro-organisms?

Dr. Miller said we might filter the saliva through a Chamberland filter and free it from micro-organisms, and see if it would then act on foodstuffs. We know that it would; these tests have been made, and by sterilization of the saliva you will find that fermentation will take place later on in certain forms of foodstuffs.

On some points of this paper I might disagree. It seldom happens that men who are working on certain lines closely agree about anything, but Dr. Hinkins lays some stress upon the xanthin, one of the products of nitrogenous decomposition, as being in the saliva. In a paper before another section I call attention to the fact that none of these productions are in the saliva. They have been found in pathological conditions, but they are rare.

I believe this paper will lead to some investigation that will be valuable in the future, and it certainly has rounded out some problems and has opened the door to some others. I think this section deserves much credit for having such a paper presented.

Dr. C. R. Taylor, Streator, Ill. I am not going to discuss this paper, but I would call attention to a fact in relation to the question raised by Professor Miller as to acids not producing a smooth and polished surface. On a lime surface it does take place under friction, as illustrated by those who polish monuments of limestone. They use oxalic acid to obtain a beautiful effect, and I do not see why the same effect might not result in the mouth. With friction, instead of leaving a roughened surface it will leave a polish. Monument-makers use a saturated solution. They moisten the crystals of oxalic acid and rub the marble with the solution, and under the friction the acid produces a beautiful polish.

Dr. E. C. BRIGGS, Boston, Mass. Dr. Taylor has said much of what I wanted to say, but in addition I wish to refer to what Professor Miller said concerning the alkalinity of saliva in mouths where there was erosion. He implied that that exploded the theory of acidity causing the erosion. Now if the mucous follicles above the incisors have become unduly active and secrete a great deal of acid, the fact that the saliva was strongly alkaline would only tend to increase the acid secretion. It is a well-established fact that all alkaline treatment directed against these acid-secreting glands only serves to increase their activity, in accordance with Anstie's law. I have obtained a great deal of improvement in cases of erosion by vigorous treatment of these glands with acids, protecting the teeth with celluloid in acetone solution.

Dr. J. D. LOSADA, Madrid, Spain. There was one point spoken of by Dr. Miller to the effect that he did not find erosion in a large number of skulls of uncivilized peoples who did not use the tooth-brush. It seems from this we must blame the tooth-brush for the erosion, because if those who do not use it never have it, it shows plainly that the tooth-brush is one of the factors in the causation of erosion. I agree with Dr. Miller that acids would leave a roughened surface, and I was surprised to hear one of the previous speakers say that acids were used in polishing limestone. You can drop acid on a stone of any kind and you will get a rough, but never a smooth surface. It seems to me the friction has much to do with it.

Dr. HINKINS (closing the discussion). I admire Dr. Miller exceedingly. I prepared this paper with the results of hard work, but Dr. Miller seems to have overlooked some points in my paper. For instance, he has dwelt considerably on alkaline saliva, creating the impression that I did not consider this phase in my paper. Dr. Miller overlooked that point. In my paper I say as follows: "These erosions we now believe to be due to the solvent action of the secretions of the mucous membranes and salivary glands of the mouth, when from constitutional causes these secretions become especially acid—or alkaline. It is very likely that there are certain lines of flow of the saliva in the mouth—channels through which the saliva flows most easily after excretion and during its movement in the mouth—and the erosion will naturally be more marked on those teeth situated in such places."

There might be special conditions under which the saliva may become alkaline. But I have never observed a case of an alkaline saliva, and I have tested the saliva of over one hundred and fifty people. Therefore I cannot base my statements on an alkaline saliva, but only on what I have found—namely, an acid saliva. We certainly have an acid condition, and the more the saliva is mixed with foodstuffs the more susceptible it is to fermentation and the increase of acidity. But it does not make any difference whether the saliva be acid or alkaline, it will act upon the cement.

Dr. Miller inquired if saliva which has been dialyzed or filtered through a Chamberland filter is still acid. I have made this experiment repeatedly, and found the acid condition to be still the same. I did not publish this in the paper, but left it broad, so that it could be discussed and I could go on and do more work. These conditions, let them be acid or alkaline, are liable to produce a solvent condition of the cement. I cannot say that every case of decay of the teeth is

caused by an acid or alkaline condition, but my analyses in over a hundred cases have shown me that they were acid every time, and what can I say otherwise? Of all the hard things with which the chemist comes in contact, the saliva of the mouth is one of the hardest. It is changed by the diet, the habits, the nervous condition, etc. When you take the saliva and try to analyze it, you cannot, because it is too complex, and in the analysis these complex substances are broken down into simpler ones and we no longer have the properties of the original substance in the saliva. So with the enzymes; you cannot well get hold of them except by the very best methods. Chemistry and the nomenclature have changed a great deal. I have had the privilege of working with some of the best men in the United States, and I am familiar with the works quoted by Dr. Miller; but they do not seem in the best line of thought today.

As regards oxalic acid. In organic chemistry there are likes and dislikes as characteristic as those of the human race. In the organic life, look at tannic acid. It will replace almost any other acid from iron salts, and form the insoluble iron tannate. The calcium oxalate is the most insoluble salt of calcium, showing that calcium will always unite with the oxalic acid radical whenever possible. This will answer Dr. Taylor's question as to why oxalic acid is used in finishing the polishing of marble. Undoubtedly, the oxalic acid acts upon the marble (calcium carbonate) to form calcium oxalate. This acts as a fine powder to rub off the prominent places and fill in the molecular spaces and hence make a smooth surface. This polishing of marble by the use of an acid agent disproves Dr. Miller's position that in erosion an alkaline saliva is necessary for the formation of a smooth surface, and an acid saliva for a chalky surface. In connection with the character of the saliva we must not forget the importance of the channels of flow through which the saliva is forced. We do not realize how powerful this force is which drives the saliva through these lines of flow until we attempt to swallow when having an exposed nerve. The pressure exerted on the nerve during the act of swallowing is so great that the tooth feels as if it would jump out of the head.

Dr. Miller seems to feel that I was a little severe in my discussion of Dr. Kirk's paper, and apparently has considerable faith in the micropolariscope. The reliability of this instrument may be illustrated by the following: We may take twenty men of about the same size and dress them exactly alike. At a distance of one hundred yards all look alike. But if each one is analyzed far more minutely, we see that all are different in composition. So with these crystals of Dr. Kirk's. They look somewhat alike. There are several thousand different compounds which look somewhat alike, but when analyzed are found to be entirely different substances. Dr. Kirk was not definite enough. If he will take these similar crystals and analyze them, he may find them to be entirely different in composition. But he did not do this in his paper.

Dr. Miller also seems to feel that too much importance was placed upon the results shown by Michaels. These results were mentioned to show that in some special cases not even an acid or an alkaline condition is necessary for the decay of cements. Some neutral substances, as potassium sulfocyanid, may be able under special conditions to act as

a solvent agent. These results have also been corroborated recently by Young and Hurst, who have shown that calcium phosphate is dissolved to a small extent by potassium nitrate and by sodium chlorid, with the attendant production of acids.

In conclusion, a few words to the beacon lights of our profession. Of these men, most of all, is the highest ethical standard expected. They should be ever willing to lend a helping hand to the young man in his research work, and to recognize, encourage, and refer to the articles which the younger men present to the profession. Unfortunately, in the past some of our most prominent men in their papers have not given the proper credit to others for the work which they have done. As a result, many young men are discouraged from engaging in research work, feeling that their investigations will not be recognized and given the proper credit and encouragement.

Dr. Hinkins' paper was passed.

The Chairman announced as the next order of business the reading of the paper by Dr. E. SAUVEZ, Paris, France, on "The Various Means of Inducing Local Anesthesia for Tooth-Extraction."

A *résumé* of the paper, which was in the French language, was then read. The paper is here summarized by presenting simply the author's conclusions, as follows:

The Various Means of Inducing Local Anesthesia for Tooth-Extraction.

[DR. E. SAUVEZ' CONCLUSIONS.]

(1) General anesthesia, because of the dangers and inconveniences it entails, should be the exception in dental surgery. On this fact is based the importance of local anesthesia.

(2) Of all the methods of local anesthesia known at the present time, cocain seems to give the best practical results.

(3) Cocain hydrochlorid is in our opinion superior to all the other preparations of the local anesthetic group.

(4) Distilled water is the best vehicle for the preparation of cocain solutions.

(5) In general practice, a satisfactory degree of anesthesia is obtained, and all accident is avoided by the use of one cubic centimeter of a fresh solution of cocain hydrochlorid in distilled water 1:100.

(6) When the injection is to exceed one centigram of cocain, a horizontal position becomes imperative.

(7) In the extraction of teeth, it is almost exclusively the tearing of the alveolo-dental ligament that causes the pain.

(8) The degree of anesthesia is entirely dependent upon the manner of making the injection. The after-effects depend on the presence of an aseptic condition.

(9) After the operation, the patient should remain in the reclining position, one-quarter of an hour in the case of injections of one centigram of cocain; from two to three hours for a larger dose.

(10) Well-executed refrigeration constitutes a good local anesthetic, but only for very superficial operations.

(11) The mixed method (cocain injection and refrigeration) constitutes the best local anesthetic.

(12) Stovain, a new local anesthetic, is a vaso-dilator, and is powerful; is less toxic than cocain, and has given the best of results up to date.

Discussion.

Dr. Elgin MaWhinney, Chicago, Ill. You can have no conception of the work that has been done by the essayist until you have read the original paper in full as already published in French in pamphlet form. The short *résumé* read gives you no idea of the subject, but simply a few conclusions thereon. First, he dwells on the point that general anesthesia is very seldom indicated in the practice of dentistry. He points out rightly the dangers, with which you are all familiar, accompanying the use of general anesthetics, due to the fact that the patient cannot be always in the required recumbent position so necessary for general anesthesia.

One or two things I am surprised at: first, the claim that in over 15,000 injections of cocain not a single disagreeable physiological effect was observed. Of course he refers to the injection of but 1 cgm. of cocain, or from 2 to 3 cgm. in rare cases. I have never used 2 cgm. of cocain when I could not get distinct physiological effect upon the heart's action—arterial pressure—even before the syringe is drawn from the site of the injection. Another point which I think is a well-established fact is that one cannot foretell which individual will be the most susceptible. Individuals who are sufferers from anemia or aortic troubles are most liable to the after-effects of cocainization.

We do not yet know the physiological conditions which contra-indicate the use of cocain. From the amount Dr. Sauvez has suggested using, he is on safe ground. I have never had any dangerous effects from the use of such an amount in the human organism. I have had very marked physiological effects—syncope, loss of consciousness, stertorous breathing, etc.—but nothing alarming. I do not believe the amount he suggests would be fatal to the individual except in the cases he points out as contra-indicating its use. In America we have come to the conclusion that where the agent is to be injected into the tissue the 1 per cent. solution is the most potent. Weaker solutions are not so potent, and stronger solutions are not so potent. The stronger solutions interfere with the local anesthetic effect of the drug. The essayist very beautifully brings out in the French text the physiological relation between the so-called synthetic preparations, and comes to the same conclusions that have been reached by some other experimenters. I published in 1895 that, all things considered, cocain was the safest of these preparations. With the new preparation stovain, of which he speaks, I am not familiar. It is the product of the chemical laboratory only two months previous to the compilation of this text. Judging from what must be the chemistry of it, I have my doubts about its being more efficacious than cocain.

To get the good result of the drug the cocain solution must be injected into the denser tissues, which requires a great amount of force. I use a slightly different syringe from that advocated by the essayist. I have the points made of platino-iridium, and find them sufficiently stiff. They can be submitted to white heat without destroying the temper. I keep my syringe clean in the same manner as the essayist does. I am inclined to question his statement that he injects the cocain into the peridental membrane. He states that there is no effect upon the nerve fibers entering into the tooth. I have stated a great many times and believe that it is possible to inject cocain

into the pericementum and extract pulps painlessly.

I want again to compliment the essayist because of the great value of the work presented; the conclusions are identical with those of many investigators who have experimented on the subject, and I trust all will read his contribution.

Dr. J. D. Losada, Madrid, Spain. I have made over 2500 cocain injections. I have tried about ten different kinds of drugs, but have come back to cocain; in my hands there is nothing like it. Cocain is blamed often for what it does not do. I have injected pure distilled water and obtained the same general effect as with cocain, at least twenty times. That shows that auto-suggestion is as responsible as cocain. It is a reliable drug if used with intelligence. I challenge anyone to prove that fatalities have ever occurred with the use of 3 cgm. or less of cocain. Bad effects are experienced equally with the use of pure water; they soon pass away. My average dose is between 1½ and 2 cgm. Some of the liquid is lost in the mouth. I have sometimes observed slight symptoms, but I knew the effect could not be great and that it would soon pass away.

I am interested in that new product stovain, but I am sure Dr. Sauvez never meant to imply that it is as good as cocain. He did not say so to me.

My experience with platino-iridium needles is that they will not bend. I use a new needle for every patient; I think that the safest plan.

Dr. C. R. Taylor, Streator, Ill. I have found that in difficult cases where the gums are very spongy, if adrenalin be applied before the injection a condition of the tissues will be obtained that will be more receptive to the liquid to be injected. By applying pressure upon the gum with the fingers until it is white, practically the same result may be obtained. By pressing the gum with the fingers hard enough to blanch it, the injection will be retained if the needle be not removed for a few moments. I have also found in sensitive individuals that by pressing the gum before the injection a local-pressure anesthesia is obtained which will allow the needle to penetrate without much pain. I understood from the paper that there was no appreciable effect of cocain on the pulps of teeth when injecting it into the gums. I think there is some mistake in that statement, because if cocain is placed in the nostrils while excavating painful teeth the analgesic effect will extend to the teeth. For the six front teeth, cocain in 5 to 10 per cent. solutions on cotton thread in the nostrils will produce this result.

Dr. L. F. Bouche, Winnipeg, Manitoba. I take exception to the statement put forth about a general anesthetic not being needed in our profession. I find that it is usually very painful to inject cocain into the gums in cases of acute alveolar abscess. The mere fact that a new medium is injected into the gum puts additional pressure on the irritated tissues. In cases like that it is necessary to have recourse to a general anesthetic. I feel sure that Dr. Sauvez must have overlooked that. I have seen cases where hypodermic injection would be almost impossible. I would like to know to what Dr. MaWhinney referred in speaking of the needles. Are they as fine as the steel needles? I have found that the injection of cocain into the peridental membrane does not render the pulp less sensitive.

Dr. MaWhinney. The platino-iridium needles I referred to are not on the market. I have had them drawn to fit the syringe. They are very stiff. My friend misunderstood me; I was not ad-

vocating injecting cocain in the gum for the purpose of taking out pulps. That the pulp, however, can be anesthetized in this manner has been proved beyond doubt.

Dr. J. G. Reid, Chicago, Ill. Relative to cocain in the nostrils to relieve pain in the six front upper teeth, I have used it in that way many times with the most wonderful success. One can operate perfectly for a minute or a minute and a half. I use a 10 per cent. solution. This plan was brought to my attention by a rhinologist about a year ago. I have only known one instance where it absolutely failed; but that patient might have been timorous and imagined it hurt when it did not. It varies in its effects from absolute insensitivity to conditions where the sensation does not greatly inconvenience the patient. I presume I have used it fifty times since it came to my attention some four months ago. I do not use it always, but when the patient is in great fear of pain it has been applied with almost absolute success.

Dr. A. H. Peck, Chicago, Ill. I have tried this experiment at least double the number of times Dr. Reid has named, and I must say that in aged persons I have failed very frequently to get satisfactory results. But in patients under twenty years of age it works almost to perfection every time.

Dr. E. E. Haverstick, St. Louis, Mo. I think lysol a better agent than carbolic acid for disinfecting hypodermic needles, because carbolic acid will corrode them and the lysol will not. I think a general anesthetic is very frequently indicated for the extraction of teeth and can be given with much more satisfaction to the patient and the operator than the local anesthetic. In preparing for the injection I dry the gums and use a 25 per cent. solution of cocain over them before attempting to introduce the needle.

Dr. Sauvez—interpreted (closing the discussion). First of all, I desire to thank Dr. MaWhinney for the courtesy of opening the discussion. I did not desire to give American dentists the idea that I am partial to extractions. My report on 20,000 extractions is due to the fact that for about twenty years I have held dental clinics in three hospitals in Paris. Dr. MaWhinney says that he has had some trouble with 2 per cent. cocain solutions, and of course I have had the same difficulty; but now I never use other than the 1 per cent. solution, and never have to record any after-effects. I never employ more than 1 cgm. for each injection. Of course sometimes it becomes necessary to inject more than that quantity. I then place the patient in the reclining position and administer 2 cgm. I do not use the iridio-platinum needles, because they are too weak, and if pointed enough they are too small and not sufficiently resistant for the injection. In the case of tumefied gums I wipe the gum before the injection with adrenalin. I do not use it with the injection any more, because I have found it unsatisfactory. In regard to the anesthetic for the front teeth spoken of, I have never used it in that way. I have been impressed with the idea that in the extraction of teeth the laceration of the ligament is the most painful phenomenon. If an injection be made through the gum no diminution of the pain in the dentin will occur. Last winter I carried on a series of experiments in Paris, by injecting cocain into the trunk of the nerve in the maxillary bone, but this never resulted in complete anesthesia.

The next paper on the program was one by Dr. L. P. Bethel, Columbus, O., on "Beneficial Results from Oral Hygiene and Prophylaxis," as follows:

Beneficial Results from Oral Hygiene and Prophylaxis.

By L. P. BETHEL, D.D.S., Columbus, Ohio.

There seems to be each year an increasing tendency toward prevention rather than cure, in various professions. In law, many prominent lawyers are now using greater efforts to keep cases out of court than to get them into court. In medicine, means and ways of prevention occupy the minds of many. In dentistry, means of prevention have also been studied, and with benefit to the public, for comparatively few teeth have to be sacrificed nowadays, on account of improved methods of treatment and restoration. Not satisfied with this, however, a number of our progressive dentists have sought to decrease, if not to prevent, caries of the teeth—the most persistent and destructive of diseases—through hygienic and prophylactic measures, and the results have shown a great step in advance toward the ultimate.

Dr. D. D. Smith of Philadelphia says that through his monthly prophylactic treatment he has noticed in mouths treated a decrease of from 70 per cent. to 90 per cent. in carious action. If such results can be obtained, is the subject of prophylaxis not worthy of more attention than has been given it in the past?

It is not my intention to enter into a general discussion of the subject. This will probably be done in other papers, but in this paper I hope to show some of the beneficial results from the practice of it, beginning with a class of people with whom oral hygiene and prophylaxis is made compulsory.

As you are all probably aware, the Diamond Match Company have for a number of years employed a dentist to keep vigilant watch over the condition of the mouths and teeth of their employees, especially those engaged in the "dipping room" and other places where phosphorus fumes are generated. While the primary object of this step was to reduce, if possible, the cases of phosphor-necrosis among match-workers, through compulsory care of the mouth and teeth, it has been interesting to watch the general results of the constant application of these hygienic measures as practiced by the employees.

About a year and a half ago, Dr. Knowlton, the examiner, invited me to visit their largest factory, at Barberton, O., and inspect the mouths of the employees. The invitation was gladly accepted and since that time I have made a trip to Oshkosh, Wis., to investigate the mouths of the employees in the factory at that place, for the purpose of verifying what I had seen in Barberton. The four factories in the United States that belong to this company contain more than two thousand employees—men, women, boys, and girls. It is the duty of the dental examiner to make every three months a rigid examination of the condition of the mouth and teeth of every employee. This is done systematically, and tabulated records are kept on file. If any teeth need filling, or if other operations are found necessary, the em-

ployee is so notified and is sent to some dentist to have the operations performed. On returning, this employee must bring from that dentist to the examiner a certificate stating that the needed operations have been accomplished and that the teeth are again in good condition. These measures are exacted of employees under penalty of discharge.

The condition of the soft tissues of the mouth, especially the gums, is also noted and necessary instructions as to their further care are given to the patient. Especial attention is given to keeping the teeth free from calcareous deposits, and to keeping the gums in a normal condition. Every employee is obliged to brush his teeth and gums at least once a day and use such mouth-washes and dentifrices as may be prescribed by the examiner.

At his next visit the examiner compares the work done with the last instructions as entered in his record-book. If any filling or other operation is found faulty the patient is returned to the dentist who performed it, with instructions to have it made satisfactory. By this strict supervision over the oral cavity, phosphor-necrosis, which used to be common among the match-workers, has been almost entirely stamped out. Aside from limiting this dread disease, this compulsory prophylaxis has been of great benefit to every employee and an educator of no small proportions. These match-workers soon see the benefits themselves and take pride in their beautifully clean teeth and healthy gums, and compulsory care of them becomes a pleasure. The employees comprise the poorer class of working people who naturally would take little or no care of their teeth. In inspecting the mouths one is impressed with this fact upon seeing the condition of the teeth and mouths of the new employees, calcareous and soft deposits with resulting gum inflammation being present. If no attempt be made to keep the teeth and gums clean and stimulated, the irritating influence of the phosphor fumes but adds to the inflammatory trouble. Even in the mouths of employees who for a time give daily care to the teeth and then become negligent—brushing the teeth and gums only once or twice a week, instead of every day—the evil effects of the phosphor fumes are seen. The gums soon become inflamed and congested, and a horrible odor is noticed about the mouth and breath. Where the brush is used diligently once or twice each day, however, and the teeth kept free by the examiner from calcareous and other deposits, the gums present a normal pink tint, are firm to the touch, and have every appearance of perfect health and tone despite the irritating tendency of the phosphor fumes that are constantly inhaled.

Now, if we find dental organs scrupulously clean, gums of a normal tint, firm and healthy, and clean mouths, where these prophylactic means have been employed, even in the face of such unfavorable surroundings and among this class of people, what can be accomplished among patients in a general practice if they can be induced to adopt and conscientiously follow out such prophylactic measures?

The examiner, through observation, says that he is confident that the influence of oral hygiene is farther-reaching than ordinarily imagined. Since its enforcement among these employees it has been a noticeable fact that fewer days are lost through sickness. He believes it has an influence on the digestive tract and that better general health is main-

tained. Also it has been noticed that during epidemics of disease fewer employees are affected by prevailing maladies than before these prophylactic measures were adopted.

After seeing such remarkable results in the mouths of a class of people who naturally give little or no attention to the care of the mouth and teeth, I was curious to see the results of constant care of the teeth of patients in general practice, and through invitation I visited Dr. D. D. Smith of Philadelphia. The results of his work were remarkable, especially those in mouths of patients who had previously been afflicted with severe pyorrheal conditions. Where pyorrheal trouble had been previously treated, excessive absorption of gum tissue in many cases was still noticeable, but the gums were tightly attached about the teeth, were of a pink healthy color, and of firm texture, showing perfect normality with the exception of gum tissue lost through pyorrheal absorption, and even that had been partially restored. Although a number of these cases had been treated years before, the gums, through this monthly treatment and general care, retained their tone, with no signs of a return of the former disease.

This of itself furnishes a valuable lesson for the general practitioner of dentistry. The results of Dr. Smith's prophylactic treatment are all that could be desired and greater than ordinarily would be expected. All the patients had beautifully clean teeth and gums—wholesome, clean mouths—and there was an entire absence of that disagreeable odor noticeable from unkept mouths. These patients invariably stated that their general health was better since they began this systematic treatment and gave their teeth and mouth daily attention at home.

Dr. William Hunter of England, Dr. Miller of Germany, and others have called attention to septic systemic poisoning from unkept and diseased mouths, and the beneficial systemic results from the adoption of oral hygienic and prophylactic measures; and the cases I have cited, and others where prophylaxis has been employed, that have come under my observation, seem to further demonstrate that an unkept mouth is a detriment to the general health of many individuals.

After a patient has selected a dentist and resigned the care of his teeth to him, he takes it for granted that the dentist will give them every attention possible for their preservation, and the patient has the right to expect the best of care from his dentist. If the daily care of the mouth and teeth by the patient, and a monthly scaling and cleaning of the patient's teeth by the dentist, will retard perceptibly the progress of dental caries, improve the general health of the patient, and keep the teeth and gums in their normal condition and make them most presentable, is it not the duty of every dentist to follow such practice? For this prophylactic treatment the dentist is entitled to a fee commensurate with the time consumed, the same as though performing any other dental operation, and I am sure the majority of patients would willingly pay for such service if its importance could be thoroughly impressed upon them; and I believe every dentist will be agreeably surprised at the readiness with which intelligent patients will take up with the regular treatment idea when they come to understand the benefits they will derive from it. This has been not only my own experience, but the experience of all dentists with whom I have conversed who practice the treatment.

I have observed no detrimental effects from this prophylactic treatment, but universally beneficial results; and to my mind every dentist should, so far as possible, practice periodic prophylactic treatment of the teeth and gums of patients, this plan being not only to the interest and welfare of patients but of the dentist as well; and I believe that the results of such procedure and practice will redound more to the dentist's credit than he may ever have imagined.

Discussion.

Dr. T. W. Pritchett, Whitehall, Ill. I am heartily in accord with the views expressed by the writer, and I believe heartily in prophylaxis and the cleansing of the teeth as a means of preserving the teeth and securing the best occlusion.

Dr. C. R. Taylor, Streator, Ill. I am afraid we do not give enough thought to the artistic as well as to the esthetic. A great many men and women are very scrupulous in their habits about bathing and yet are careless about their teeth. They take care of their hands, employ specialists to care for their fingers, and yet give hardly any attention to their teeth. If they have toothache they will have the pain relieved. This paper of Dr. Bethel's clearly shows that definite results come from the care of the teeth. We cannot lay too great emphasis on prophylaxis of the mouth. We should instruct our patients in the methods of keeping the teeth clean, and then insist on having them use good hard food for stimulating purposes.

Dr. Emma E. Chase, St. Louis, Mo. This subject is of great interest to me. I think it must be so to any woman practitioner, because it is rather the province of women to go after things and clean them up. I think we dentists have always been great theorizers, and when we get such testimony as is given in this paper as to what can be done not only with chosen patients—rich people—but what can be done with poor people, I think it of great value to the profession. Pains should be taken to give as great publicity to these facts as possible, because I think that people like definite facts. If they know this improvement has taken place, if we can show them that they can improve their health and prevent decay by keeping the teeth in good condition, it will encourage others to do likewise. If the teeth of my patients are not clean I make it a practice to have them look at their teeth in the looking-glass; I then inquire how much time they devote to cleaning their shoes, and I find they usually spend more time cleaning their shoes than their teeth.

Dr. J. E. Hinkins, Chicago, Ill. I have long ago given up hope of doing anything with people of mature years, but have had a good deal of satisfaction in results obtained through the public school teachers, for instance. When I have a teacher for a patient I impress the importance of having the school children keep their teeth clean, and get them to ask the children when they come to school if they have cleaned their teeth. If they have not, they are excused until they do so. I have even gone so far as to donate tooth-brushes to a school. I have letters from school teachers saying there has been a wonderful change in the school since the children have kept their teeth clean. They say to them, "You have clean shoes and a clean collar, but look at your teeth!" They say the school-room has been almost revolutionized.

Dr. E. C. Briggs, Boston, Mass. I

can only say, as did Dr. Taylor, that the vigorous action of the jaws contributes something to the conditions necessary. The teeth of a person who gives them plenty of work to do have better nutrition, and there is less danger of auto-intoxication where the teeth are kept clean by nature's use of them; but of course this does not mean that we must not do a great deal besides. Even the water should be taken into the mouth and revolved around and swallowed slowly. Articles on this question were written some years ago by a layman who has of late received a great deal of scientific encouragement, and his theories are being looked into by scientists.

Dr. BETHEL (closing the discussion). This subject has interested me for a long time. I have presented a number of papers during the past ten or twelve years, and I believe that people are being instructed by dentists at the present time more than ever before. The work is progressing, and I hope it will continue to progress until every dentist can see the benefits that will result from a thorough understanding of its importance. Another thing: When we are at the chair we inhale the patient's breath almost constantly, and I think the dentist should take some precautionary hygienic measures after he has dismissed his patients. For instance, he should not only care for his own mouth and teeth with the use of antiseptic washes and powder and brush, but he should wash out his nostrils as well. We undoubtedly inhale many bacteria from the patient's breath during operations, and such precaution is only a preventive measure that every dentist owes himself.

A paper by Dr. RICHARD GRADY, Annapolis, Md., entitled "The Benefits of Mastication and Insalivation," was on motion presented by title. The paper was as follows:

The Benefits of Mastication and Insalivation.*

By RICHARD GRADY, D.D.S., Annapolis, Md.

HE didn't have time to chew
The food that he had to eat,
But he washed it into his throat
As if time were a thing to beat.
At breakfast and lunch and dinner
'Twas a bite and a gulp, and go.
—*Biography of a Fool.*

GENTLEMEN, we must change our ideas, and must come to a proper understanding of what teeth are for. They are not for mastication in our present civilization . . . . When we come to speak of their necessity—no! they are not necessary to the preservation of health. Mastication or insalivation is not a necessary process at all, and I emphasize *that*, although I know every gentleman here will oppose me in it . . . . The idea that insalivation is a necessary process is a fallacy. With the amount of sugar that we usually have, water is just as efficacious as saliva. Now, many of you will consider these expressions of mine as heterodox; but they are not. —Dr. D. D. SMITH.

THE words of Dr. Smith here quoted, were spoken by him at the meeting of the Southern Branch of the National Dental

* [Before I began the preparation of this paper or had a stenographic report of the remarks made by Dr. Smith, someone (I will not say "mischief-maker") had written to Dr.

Association, in Washington, D.C., February 1904—"ideas" strikingly at variance with opinions heretofore in vogue, especially with Gladstone's, which advocated the chewing of each morsel of food thirty-two times, once for each tooth.

Acknowledging at the meeting the manly and professional character of Dr. Smith, and the influence of his system of oral prophylaxis, which it would be difficult to overestimate, and deploring the expressions of dentists respecting Dr. Smith and his work, which I quoted that month in the *Dental Cosmos* ("I guess we don't want anyone to teach us to clean teeth." "The cleaning of teeth once a month is all tommyrot." "If I adopt this system and stop decay, what am I going to do?"), I however challenged the foregoing statement, which arrested my attention, believing such teaching misleading and harmful; and invited the study of "Some Observations on Mastication," by Henry Campbell, M.D., published in the London *Lancet,* which I had not seen mentioned in any dental journal, and which I shall use in part in this paper, because I consider the subject of much practical interest, hoping that the recurrence of certain ideas may obtain for them the importance which I give them.

Sweeping generalizations of the kind uttered by Dr. Smith represent nothing more than an incomplete and necessarily one-sided investigation of the human body apparently not in a state of health as the standard; for he said in Washington, if by giving "things that are taken into the stomach without insalivation and without mastication . . . . we can build up the health that is broken down, why can we not by the same means maintain the normal state of the health —a much easier matter?"

Inferences based on such statements must always be taken subject to correction. Can anything be more at variance than this notion of Dr. Smith, which he admits "every gentlemen here will oppose" and many will consider "heterodox"? It is in line with the theories by which dyspepsia is to be banished, and the doctor avoided; or those in which one man teaches that all food of whatever kind should be eaten uncooked, and another denounces the eating of any form of meat, while a third instructs us that the consumption of nuts will give the most strength; or those in which we are told to sit or lie naked in the sun, to wear only wool next to the skin, or silk, or cotton—according to the predilection of the adviser; or those of the Chicagoan who is preaching against all forms of bathing, while others advise baths for the cure and prevention of every form of disease; or the proposal to perform appendectomy on every child as systematically as vaccination—an obvious *reductio ad absurdum.*

Smith thus, "Did you know that Dr. Richard Grady of Baltimore is preparing to try and jump on you?" About this time Dr. Smith wrote me, "The time will come at no distant day when you will quite agree with me on the question of the *necessity* for mastication with the teeth. As for insalivation in present mouth conditions, it would be far better supplanted with water and customary drinks. You have only to look about you and observe the condition of the edentulous and of those reduced to a very few teeth. They are generally in far better condition of health than people in middle life with full sets of natural teeth . . . . Better go slow in condemning the (imaginary) 'faults,' for your condemnation will surely react. What if my views are radical? That is not a matter for discussion. Am I right? Yes." In reply, I assured Dr. Smith that I never indulged in personal, offensive criticism; and that I would discuss "the fault and not the actor of it."—R. G.]

As chairman of the National Dental Association committee on oral hygiene in public schools and institutions, endeavoring to inculcate the habit of efficient mastication in children, and teaching that "without mastication there cannot be perfect digestion, without perfect digestion there cannot be proper assimilation, without proper assimilation there cannot be nutrition, without nutrition there cannot be health;" I feel it my duty to take exception to the clever representation of Dr. Smith, as unthinking persons might mistake for acquiescence the silence of polite forbearance and accept the *ipse dixit* of one of the successful educators of the public along dental lines as the voice of the profession. It is as true today as when uttered two hundred years ago by Dr. Arbuthnot, that "mastication is a necessary preparation of solid aliment without which there can be no good digestion."

You cannot change the essential nature of things. You cannot make black white—though a clever man like Dr. Smith may make it seem so. In the words of one present at the meeting, "Dr. Smith is evidently a brainy old gentleman, but the 'brainier' the ——— the more dangerous. This statement of his may possibly mislead some of the easily influenced of our profession."

I was staggered by Dr. Smith's "heterodox" expressions. I had never looked at mastication or insalivation in that precise light—erroneous light, in my opinion. If I have a long-founded belief which has been disturbed, shall I go bravely to meet a demolition of my views, preferring to encounter a shock to those conceptions, or shall I carefully run away from disturbing thoughts? If I am in a meeting where an opinion that I hold to be based on truth is vigorously opposed, have I the courage to defend it? Those who are anxious to learn are those who recognize their shortcomings. They possess that "divine unrest" which is the mainspring of progress. The only true and satisfactory attitude is that of the historian Freeman, who wished it to be said of him that he died learning. What is more lamentable than a self-satisfied professional man who fancies that he has nothing more to learn?

My conception of the question is expressed with clearness of thought and directness of statement in these words of Dr. Belcher of Buffalo: "We must remember that in the healthy individual all the organs and viscera should be called upon to perform their physiological functions." There are writers and speakers who take the attitude that if the facts do not fit their theories, it is so much the worse for the facts. They go to their imaginations for their facts, or rely upon unverified evidence in support of their preconceived notions. The theory has been promulgated that it is not necessary to masticate the food for the stomach; and while advocating the value of prepared and predigested foods in certain pathological conditions we must remember that in the healthy individual all the organs and viscera should be called upon to perform their physiological functions, and he whose teeth can masticate real food, whose ptyalin converts starch, and whose gastric, intestinal, and other digestive juices are called upon to fulfill their functions is in a far more physiological condition than the spoon or bottle-fed consumers of the concentrated and predigested nutrients so much lauded in the advertising columns of our journals and upon every city billboard.

The maxillary apparatus of man hav-

ing for long ages past been put to vigorous use, it is not surprising that the need to exercise it should express itself as a powerful instinct. The teeth are a provision for biting hard foods, but even before they actually appear we find the child seeking to exercise his toothless gums on any substance he can lay hold of, and there can be no doubt that exercise of this kind tends to facilitate the eruption of the teeth—a truth recognized universally. This instinct to chew for chewing's sake manifests itself all over the world. Thorough mastication not only subdivides the food mechanically, but the saliva which is secreted under the twofold stimulus of the taste of the food and the movements of mastication tends to dissolve such parts as are soluble in water and to convert the insoluble parts into a pulp.

But the effects of mastication are not limited to the changes produced by it in the food within the buccal cavity; the taste of savory meat, the rolling of a sweet morsel under the tongue, and the movements of mastication exert an influence both on the stomach and on the brain. The effects on the stomach are shown in a case of gastric fistula, where the esophagus being completely occluded, mastication of food induced secretion of gastric juice, although nothing could pass from the stomach on account of the obstruction. The effects of mastication on the nerve centers are perhaps still more important, for it is obvious that the secretion both of the saliva and gastric juice takes place reflexly through the medium of the nerves. The mere act of mastication not only supplies a stimulus to the peripheral ends of sensory nerves in the mouth, but it leads to an increased supply of blood to the nerve-centers; the current of blood in the carotid artery of a horse became three times as rapid during mastication as it was before. When food is thoroughly masticated it is swallowed, and the act of swallowing sets in action a mechanism which is calculated to increase the blood supply not only to the nerve centers but to all the glandular structures concerned in the digestive tract. The movements of mastication are peculiarly adapted to bring out the full taste value of substances taken into the mouth, and the act of swallowing by which the morsel is rubbed between the tongue and the palate has been proved to develop tastes not appreciable by simple contact with the sensory surface.

The size of a bone is largely determined by the degree to which the muscles attached to it are exercised. The teeth being developed within the jawbones and remaining even after eruption in close anatomical and physiological association with them, must necessarily share in their nutritive tendencies. If those bones be efficiently exercised during the formation of the teeth (especially the permanent set) the tooth-germs will be abundantly flushed with blood, while the ample growth of the jaws themselves will provide the germs with plenty of room in which to grow and develop, and the more perfect their growth and development the more resistant will they prove to the ravages of caries. The influence of mastication on the masticatory muscles, the salivary glands, the nasal passages and sinuses pertaining thereto, the naso-pharynx, soft palate, and tonsils need not be discussed, but simply mentioned.

Imperfect use of the teeth leads to many ills. When adequately exercised and made to execute for one or two hours every day a lively dance in their sockets, during which the circulation of blood

and lymph in the tooth-pulp, pericementum, and surrounding tissue of the gum is vigorously stimulated and the cavity of the mouth is bathed in a copious flow of salivary and other buccal secretions, we have conditions which make alike for the health of the buccal mucous membrane, of the teeth, and of the pericementum and alveoli; but when the circulation is not stimulated in this way the teeth do not develop properly, while the secretions of the mouth are apt to be scanty and unhealthy—both of which conditions predispose to caries.

Says Dr. C. N. Peirce on the necessity of proper mastication, "The food is often washed into the stomach with one of various liquids without mastication, and we may with safety and great propriety add that, unless there is some change in the food habit of children, our success in the direction of tooth-preservation will be but limited. Solid food must be substituted for semi-solid, and the eight or ten minutes usually occupied in the consumption of a meal must be extended to twenty-five or thirty minutes. Food should be taken as nearly dry as possible, and let the child spend half an hour or more in its mastication, utilizing the natural secretions—not washing down its food with copious draughts without an effort on the part of the teeth to triturate and prepare it for the subsequent digestive process. I want to make it clear that, in my estimation, the loss of function is one great cause of this rapid decay of teeth. The healthy or normal development of the teeth is exactly in proportion to the stimulus of the resistance that is offered to them in the mastication of food."

Inquiring into the causes of defective mastication, by far the most important is softness of food—the kind which does not compel thorough mastication. This feature is especially noticeable in the case of children's diet. What opportunity in this "age of pap" does such food afford for the development of teeth and jaws and for the proper functional activity of the salivary glands? In this hurrying, strenuous age, people are much less deliberate than in the easy-going days of long ago. A meal is too often regarded as something to be got through quickly, as taking up time which might be devoted to something more profitable. People acquire the habit of bolting their food. A meal should be regarded as an end, and an important end in itself. When food can be swallowed easily without mastication, few will take the trouble to masticate it, especially children. Too often the stomach of the child is literally deluged with starch. This practice—beside leading to the more immediate troubles connected with flatulent dyspepsia—gives rise to abundant formation of toxins which by irritating the alimentary mucous membrane set up gastro-intestinal catarrh. These poisons being absorbed into the blood the tissues become saturated with them and the nutrition of the entire organism is disturbed. The faulty metabolism manifests itself by diminished resistance to pathogenic agencies, as shown by a liability in children thus fed to bronchitis, rhinitis, naso-pharyngitis, and tonsillitis; by their proneness to tuberculosis; and finally by a predisposition to rickets. Thorough mastication is, it may be concluded, the most effective way of securing efficient starch digestion. The more efficiently food is masticated the greater is the salivary flow, and the more intimately is it mixed with the saliva, or insalivated.

The presence of masses of imperfectly masticated food in the stomach may

cause disturbance either mechanically or by reason of their imperviousness to the gastric juices. Compact lumps tend to undergo abnormal chemical change in the stomach, and may in this way cause violent local irritation, even to the extent of setting up acute gastritis; or they may paralyze the nerves of the stomach and check gastric secretion and movement, and thus remain *in loco* wholly undigested for hours or even days; or again, more distant nervous effects may be produced—such as frontal headache.

Insufficient mastication conduces to excessive eating. A danger at all periods of life is to consume not only more food than is needful, but more than is healthful, the stomach being literally deluged with nutriment. Thorough mastication not only tends to diminish the amount of food consumed on account of the time and labor it entails, but it actually reduces the amount needful to constitute a sufficiency; for the more perfectly the food is chewed the more perfectly is it digested and the more economically is it disposed of in the system. It is certain that appetite and the needs of the system are sooner satisfied when food is well masticated and digested than when it is swallowed whole. While the stomach is the organ especially liable to be injured by the swallowing of lumps of unmasticated food, the bowel may also suffer, especially the cecum and vermiform appendix. And here we come to one of the most serious indictments against the bolting of food. Treves points out that in this rushing age people, especially business men, are apt to hurry over the meals and to take them at irregular times and often while standing at a bar. Even when there is more leisure, food is rarely masticated nowadays in the same thorough way as when it was of a coarser nature: hence solid lumps are apt to pass beyond the pylorus, and, escaping intestinal digestion, to lodge in the cecum and precipitate an attack of appendicitis, the most common predisposing cause of the latter being a loaded cecum, often preceded by constipation.

That it is possible to maintain on ordinary civilized diet a fine set of healthy teeth till past middle life, provided the food be habitually subjected to efficient mastication, is shown in this illustrative case of Dr. Campbell, which I quote in conclusion:

"It is that of a man in his fiftieth year. I was not a little surprised to find that all his teeth were sound—a very unusual occurrence among the London poor at his age. In seeking for an explanation I elicited the fact that he was unable to swallow his food without chewing it very thoroughly, and on giving him a moderate-sized piece of bread, with the request that he should chew it in the ordinary way, I found that he subjected it to one hundred and twenty separate bites before swallowing it, and in the steady, deliberate way he went to work and in his extensive lateral movements of the mandible, he reminded me of a cow chewing its cud. The temporals and masseters are enormous, and the like is no doubt true of the pterygoids. He has well-developed nasal passages, has never suffered from nasal obstruction, while his buccal mucous membrane is unusually healthy.

"May we not attribute this healthy state of the mouth, teeth, and nose to the good effects upon them of efficient chewing? Here is a man who has lived for thirty long years in London on the same kind of food as the average poor Londoner, but instead of finding his mouth full of carious, tartar-coated

teeth and spongy, receding, pus-exuding gums, we find thirty-two sound teeth, firmly set in healthy gums and all but devoid of tartar."

The following paper by Dr. J. H. Schlinkmann, Baltimore, Md., "Electro-Absorption in Therapy," was also read by title:

Electro-Absorption in Therapy.

By Dr. J. H. SCHLINKMANN, D.D.S., Baltimore, Md.

Before entering into a discussion of the electro-absorption of drugs in the treatment of diseased tissue, two essential questions must be answered: (1) Has the direct or indirect current, alone, any therapeutic value? (2) How does the electric current force the tissues to take up medicaments?

Many practitioners and authors have emphatically denied that the electric current has any therapeutic value. In the same vein as this very skeptical attitude, which certainly lacks justification, there is offered as an explanation for the efficacy of the electric treatment the psychological factor "suggestion." This view is taken by many, rather than grant that there is any specific therapeutic value produced by the action of the current.

If this hypothesis be correct, then it will not be necessary to use any special method in applying the current in the treatment of diseased parts. The essential thing to do would be to work on the mind of the patient through the vibratory influence of the current, through the impression caused by the appearance of a very elaborate appliance, and the striking effects accomplished with the battery (muscular contraction, flashes of light before the eyes, the rubefacient effect on the skin). It would be possible to attain the same effect by numerous other methods. If such were the case we should get equally as good effects from the faradic as from the constant current, or from the anode or cathode of the direct current when applied to the affected parts.

If we take into consideration the physical properties of electricity, and judge by its working spheres, the acceptance of a material effect seems evident from the beginning—the influence it has on cells of the tissues, stimulating, retarding, or changing the direction of motion of the minute parts of the living body. When two metals—as, for example, a piece of zinc and a piece of copper —are immersed in a liquid (*i.e.* a weak acid solution) they acquire a particular form of potential energy — electrical energy—under a certain tension, which is different in the two metals. Such a combination is called a galvanic cell. From a number of such cells, or others of a similar kind, is derived the direct or galvanic current.

When the constant current is used as a stimulant to diseased tissue, or as an anodyne or sedative for the relief of pain, the difficulty which the battery has to contend with is the great resistance the human body offers to the passage of the current. For this difficulty a great difference in potential must exist between

the two terminals. That is, the battery must have a high electro-motive force in proportion to the resistance offered. The resistance of the skin, which acts almost as an insulator, must be reduced to a minimum by the most perfect contact of the electrodes. As the presence of moisture lowers the resistance, the sponges attached to the anode and cathode are always moistened before beginning the treatment. The resistance which is met with in the application of the current is not due entirely to the body resistance. Allowance must be made for the opposing forces, polarization and self-induction.

It is found that the current from the voltaic cell rapidly diminishes in intensity, so that in a short time there is a decided reduction in the activity of the cell, or it may cease its action altogether. This may result from a number of causes, the principal of which is the collection of hydrogen gas on the negative plate, thus causing polarization of the cell. In further explanation: As the current circulates through the cell it decomposes the electrolytes in the exciting fluid, and here, as in all cases in accordance with the law of conservation of force, work done cannot be lost—it must in some way be returned; hence a counter electromotive force is set up which opposes the current, and is quite as detrimental as if the resistance of the cell had been rapidly increased. The electrolytic product of the decomposition is hydrogen, and it is not until it has been gotten rid of—as by its re-combination with some compound in the fluid—that the cell can be said to have recovered itself. It is interesting to notice that in producing this condition of polarization the hydrogen acts as if another metal of an opposite electrical value had been introduced into the fluid.

From Ohm's law it is obvious that anything which tends either to diminish the electro-motive force or increase the resistance of a cell must correspondingly reduce the current strength.

The principal effects of polarization are the following: (1) The presence of hydrogen bubbles on the negative plate sets up an electro-motive force in an opposite direction to the one acting from the positive and negative plates. The effective electro-motive force is then equal to the difference between the two. (2) The effective surface of the negative plate is decreased by the presence of the highly resistant hydrogen gas; and the internal resistance of the cell is increased and the current is proportionately decreased.

METHOD OF PREVENTING POLARIZATION.

(1) Any mechanical method of removing the hydrogen gas from the negative plate, such as brushing the plate or keeping the liquid of the cell agitated, would diminish polarization.

(2) Polarization may be prevented by surrounding the negative plate of the cell with some oxidizing material which is capable of forming a chemical combination with the nascent hydrogen. In this manner, the two chief causes of polarization are prevented; HNO_3 (nitric acid), CrO_3 (chromic acid), MnO_2 (manganese dioxid), $Ca(ClO_2)$ (calcium hypochlorite) are commonly used for this purpose.

(3) By placing the negative plate in some salt whose metallic element can easily be replaced by hydrogen, polarization can be entirely prevented. The chemistry of the Daniell and chlorid of silver cells will illustrate this principle.

To get a practical illustration of polar-

ization, have a battery of at least ten ohms resistance. Connect the terminals of your cells to the terminals of a galvanometer. When the needle comes to a rest, immerse the elements in the dilute acid; notice that the angle of deflection diminishes rapidly for a time, then more slowly. Allow the cell to continue action for ten minutes, and then jar or brush the gas from the negative plate, when the cells will be found to have recovered their strength.

From the simple galvanic cell we give the metallic connecting arc any desired form, as for example a spiral. If this spirally connecting arc be rapidly brought near another metallic electro-conductor, such as a second spiral, a galvanic current will also occur in the second spiral at the moment of its approach—this is the law of induction; and when the second spiral is rapidly withdrawn from the first spiral, a galvanic current again occurs in the second coil. The first spiral is known as the primary coil, and the second as the secondary coil.

In all apparatus the secondary coil—which, as we know, is tubular—may be moved over the cylindrical primary coil. An iron core is inserted in the primary coil, and is magnetized by the primary current and serves to strengthen it—consequently to strengthen its inductional influence upon the secondary one. If it be drawn out, the primary as well as the secondary current becomes weaker; the farther it is inserted the stronger will become both currents. The farther the secondary coil is removed from the primary one the weaker is the induced current; the latter will be at its maximum intensity when the secondary coil completely surrounds the primary one—that is, when the coil distance which may be read from a centimeter scale is exactly 0.

The continual changing of the current direction of the secondary coil, repeated many times in a unit of time, will naturally result in the poles also changing their positions; that which is the anode in the first fraction of a second becomes the cathode in the next. We cannot, therefore, really speak of a faradic anode and cathode as we distinguish them in the constant current, and, as a matter of fact, we do not make the distinction in therapeutic practice.

Owing to the very rapid manner in which the faradic current changes its poles, we do not get the proper results when we try to force solutions into the tissues with it. The ions of the drug are first repelled and then instantly attracted, and about the only thing we succeed in doing is blistering or reddening the skin. Just as the primary coil has an induction effect on the secondary coil, so the separate windings of the primary have a sort of induction effect upon each other. This peculiar action of the coil contained in the same spiral is known as self-induction.

Our theory assumes that every body contains a certain quantity of electricity, but that this electricity is intimately bound to the body in question, so that it can be freed only by an interaction with other bodies, *i.e.* by certain physical and chemical processes. All this applies to the animal organism as well as to inanimate bodies. A measurable quantity of electricity can easily be freed by friction of the dry hair, provided the surrounding atmosphere be in a relatively propitious state. So every internal process is accompanied by electrical phenomena, and it is not at all impossible that Sir Benjamin Ward Richardson hit upon a vital truth when he assumed that all members of the body—the pericar-

dium, the periosteum, the capsules of the kidneys, and the membranous envelopes of the nervous system—not only serve for a mechanical protection and support, but that they possess, in addition, a special function of great importance as electrical insulators—thus preventing accidental interaction with other bodies, and retaining the normal quantity of electricity in each organ.

Before attempting work along this line, we must understand how the electric current when applied to the body passes through the tissues and diffuses itself therein, and what law governs this flow. We have as yet given little attention to the comportment of a current in conductors whose composite constituents offer varied resistance to the current flow. The human body is such a non-homogeneous conductor, and the study of the laws that govern the flow of currents in the human body must be begun with the all-important law that governs the flow of currents in any conductor, namely, Ohm's law, expressed in the formula $C = \frac{E}{R}$. The only factor of this formula that differs, with respect to present studies, from the same factor thus far studied in other relations, is R, the resistance—for in all applications of electricity to the human body the resistance is made up of the resistance of the apparatus employed plus the resistance of the body itself. To understand the resistance or conductivity of the body we must look upon it as a composite mass made up of different conductors, whose conductivity mainly depends upon their aqueous constituents. Any component of the human body will offer more or less resistance to the electric current according to the less or more water—or rather the water and salts that make up the tissue fluids—it contains. Thus it has been found that next to the horny appendages and hair, the epidermis is the poorest conductor of electricity, while the brain is the best. The entire nervous system is a good conductor, and even the peripheral nerves, according to the experiments of Alt and Schmidt with the Franklinic current, conducts six times as well as does muscular substance. Fat, muscular sheaths, tendons, cartilage, and bone are very bad conductors, but by no means so bad as to present a barrier to the passage of the current. The conductivity of a tissue being dependent upon the quantity of tissue fluid contained, we can easily understand that certain parts of the surfaces of the body will present more resistance to the current than will certain other parts. It will be found that parts exposed to the atmosphere have a higher resistance than those that are habitually covered—that a hyperemic or perspiring skin has less resistance than an anemic or dry one; that calloused, scarred, atrophic parts of the skin present more resistance than parts not so affected; and that one and the same part of the surface of the body, in one and the same individual, have a different resistance at different times.

One of the facts to be gleaned from this is the all-important one that resistance of the epidermis is so much greater than all other parts of the body that, for electro-therapeutic application, the body may be considered as a mass whose resistance is that of the epidermis. So, also, because of this high resistance of the skin, the law that the resistance of a conductor is in proportion to its length may be disregarded.

The first experiments that have been recorded in the electro-absorption of drugs were made by Pirvate of Venice.

It is claimed that he began work along this line in 1747; but this has been disputed by many authorities. Dr. Benjamin Ward Richardson made a memorable effort to introduce into practice a method of local anesthesia by the use of an electric current and drugs, terming the procedure "voltaic narcotism." The drugs used in this experiment were tincture of aconite and chloroform. By using this mixture at the anode, and applying it to the leg of a dog, complete anesthesia was produced in eleven minutes, and the limb was amputated without pain. He also operated on a nævus anesthetized in the same manner, and reported five cases of painless extraction of teeth, using in the latter case a wire at the positive pole, wrapped with cotton saturated with the solution.

These early experimenters were really mystified by the results obtained from the use of the current in connection with medicinal agents. They could give no satisfactory explanation as to how or in what direction the drugs were forced into the tissues; what physiological action the current had upon normal and diseased tissue; what part of the tissues were forced to take up the drugs and distribute them to the circulatory system. Nor were they able to determine whether the current flowed from the anode to the cathode, or *vice versa*.

It was claimed by Porret, in 1815, that the direction in which the medicines were absorbed depended on the direction in which the electric current flowed. Yet he was forced to acknowledge that he was unable to satisfactorily prove the direction of the current. It remained for later experimenters to discover that the current invariably flows from the positive to the negative pole of the battery.

Remak demonstrated that diseased tissue could be restored to its normal functions by the aid of the direct current. Of this process he said, "It is both physical and physiological, and of a very complex nature." It is believed that neither the electrolytic, cataphoric, anophoric, contractile, nor electrotonic action of the direct current alone are sufficient to produce a permanent benefit, which the employment of such a current in therapeutics is said to afford. It is considered by many writers that there are numerous effects that have not been experimentally demonstrated, but are still theoretically quite probable, that follow the application of the current in addition to those that can readily be described. To cover these known and assumed actions Remak has given the name "catalysis."

Catalysis may be said to include both cataphoresis and electrolysis, together with certain other functions which go to produce the effects classified above, and the leading points in which may be selected as follows: (A) Dilatation of bloodvessels and lymphatics with impulse to the circulation, which depends on the passage of the electric current. (B) Promotion of osmosis. And following upon these processes is an increase of tissue bulk, especially in the muscles. (C) Increased power of absorption conferred upon the tissues. To these may be added the influence upon molecular exchange and nutrition effected by exciting or soothing the nerves directly or indirectly through the parts which they supply. Changes in molecular arrangement of vital structures and their nutritive activity, due to the phenomena of electrolysis; and finally, the consequences of the mechanical transference of fluids from one pole to another. We have this in catalysis, a connecting and overshadow-

ing link between cataphoric and electrolytic influence of the current.

But to the electrical absorption of drugs and solutions the name electro-endosmosis would be preferable (endosmosis signifying a pushing from without inward), and more explicit than cataphoresis, which is defined as pushing through a diaphragm or septum. When any drug, fluid, or solution is brought into contact with the electrodes of a battery, it is broken up, dissolved, or separated into positive and negative ions. The negative will be forced to travel toward the anode or positive pole of the battery, while the positive ones will be found collected about the cathode or negative pole. If the electrodes of a battery are separated by a membrane of hard or soft tissue the different ions, according to their electrical value, will be forced cataphorically through the tissue to reach the electrode having an entirely different electrical value. When the drugs have been split up by the current into their respective ions, they, in their effort to reach the electrode which attracts them, are caught by the protoplasmic cells and are assimilated or carried to the circulatory system. They are taken up by these cells in the same manner in which the fat cells of the hibernating animals are brought into the circulation, and thus go through the process of assimilation. "By assimilation they borrow their substances from the molecules of the surrounding parts, while at the same time and in equal proportions they abandon other molceules of these same principles by a proeess of separation." This assemblage of phenomena is termed nutrition. In this manner H_2O, C, Ca, P, Fe, and other principles, evaporate in forming globulin, fibrin, musculin, and other organic substances, which by their combination constitute the anatomical elements of the blood, the muscles, the bones, the nerves, the body: in a word, this is assimilation.

By the action of the electric current, inflammatory processes may be produced or retarded, hemorrhage increased, decreased, or arrested, blood and other fluids coagulated, hard formations liquefied. By the aid of drugs and the proper use of the current many diseased parts that would not yield to the treatment of medicaments alone may be restored to their normal functions.

When inflammation or any abnormal condition exists, with either an active or passive hyperemia, the nutritive carrying cells refuse to continue their functional work. But by the use of the current the ions of the solution used are forced beyond and through the diseased parts in their endeavor to reach their pole of attraction. The current by its stimulating and contracting power sets up processes of resolution in the tissues, which are hastened by the drug that is forced into them.

In treating diseases of the hard and soft tissues with the electric current in addition to chemical solutions, we should be able to determine the electrical value of the drugs to be used. If the solution be of a positive value, and we want to force it deeply in the tissues, it should be applied by the anode of the battery. It would then be repelled by the positive pole and attracted by the cathode. Should the solution be negative the other electrode will not force the drug into the tissues, but attract it, thus causing the separated ions to cling closely to the cathode. This is due to the fact that the current flows directly toward the negative pole.

If in the treatment of peridental

inflammation we place one electrode high up on the buccal surface and the other electrode on the palatal surface, we can force the drug through the tissues from pole to pole, and thus get the full benefit of the physiological action of both drug and current.

The following were presented by Prof. Dr. JESSEN of Strasburg, Dr. LOOS of Vienna, and Zahnarzt GEORG SCHLAEGER.

I. "Zahn-hygiene in Schule und Heer." II. Eine Wandtafel für den Ausschauungsunterricht in der Schule in Farben, "Gesunde und kranke Zähne." III. Eine Wandtafel, ii. Auflage auch Farbig, "Die Zähne und ihre Pflägc."

A paper was presented by Zahnarzt Dr. SCHAEFFER-STUCKERT, Frankfort-on-Main, Germany, on "Paranephrin-Ritsert," as follows:

Paranephrin Ritsert, ein neues Nebennierenpräparat in Verbindung mit Local-Anaestheticis in der Zahnheilkunde.

Von Dr. SCHAEFFER-STUCKERT, Zahnarzt, in Frankfurt a/M.

MEHR noch wie in den Vereinigten Staaten hat die Frage der Local-Anaesthesie die Fachwelt in Deutschland in der letzten Zeit beschäftigt und wenn nicht alle Zeichen trügen, stehen wir erst am Anfang einer grossen Bewegung, die auf nichts Geringeres hinzielt, als die seither nur für Extractionen angewendete Injection von Local-Anaestheticis auch bei allen anderen Zahnärztlichen verrichtungen, die mit Schmerzen verbunden sind, einzuführen.

Diese Bewegung kann von dem gewiss zu billigenden guten Grundsatz ausgehend, unseren Patienten so human wie moglich die Hülfeleistung zu gewähren, auf Unterstützung und Beachtung der Fachwelt Anspruch erheben. Sie muss sich aber gleichzeitig bewusst sein, dass sie eine Bahn betritt, deren Verfolgung nicht ohne Gefahr ist und deren Endziel schwer zu bestimmen sein wird. Schon das Versprechen absolut schmerzloser Extractionen, Excavierungen, Pulpen extirpationen etc., ist von Seiten der verschiedenen Präparate dem Zahnarzt gegenüber sowohl als von Seiten der Zahnärzte den Patienten gegenüber nicht ohne Rückwirkung auf die Beurteilung der sonstigen Tätigkeit ohne diese mittel. Und nicht minder harmlos ist die dadurch hervorgerufene häufige und allgemeine Anwendung der mittel selbst, die in ihren Hauptbestandteilen Cocain und Adrenalin absolut nicht zu den ungefährlichen Gliedern unseres Medicamenten Schatzes zu rechnen sind. So wenig ich also den Wert der Local-Anaesthesie verkennen möchte, so möchte ich doch bei Behandlung der vorliegenden Frage vor einer "Popularisirung der Injections-Anaesthesie" warnen, und ihre Anwendung nur in ausgesuchten Fällen, nur bei äusserster Nothwendigkeit und soweit dies möglich nur mit möglichst ungefährlichen Mitteln empfehlen.

Die Wahl des mittels hat mir Veranlassung gegeben, mich mit dem Thema

des heutigen Vortrags zu beschäftigen mit einem Nebennierenpräparat, Paranephrin Ritsert, dessen toxische Wirkungen denen der seitherigen Präparate nachsteht, dessen anaemoresierende Wirkung desselben gleichkommt.

Werfen wir einen Blick auf die Entwicklung der Local-Anaesthesie in der Zahnheilkunde seit Einführung der Nebennieren präparate.

Wir danken das erste und lange Zeit einzige Nebennieren-präparat Ihrem Lande, das uns durch Takamine in der Firma Parke, Davis & Co. das Adrenalin lieferte. Es ist Ihnen ja allen bekannt, dass in der Nebenniere gesunder Tiere eine Substanz enthalen ist, die Veränderung des Blutdrucks und Erregung der Glatten muskeln hervorruft. Fürth isolierte als wirksame Substanz das Suprarenin, Abel nannte die Substanz Epinephrin. Nach Singer sind diese beiden Zersetzungsphasen der Muttersubstanz, die Takamine und Adrick als Adrenalin darzustellen gelang.

Das Adrenalin von Parke, Davis & Co. ist eine leicht krystallinische Substanz in kaltum Wasser schwer, in heissem Wasser leicht löslich. Es bildet mit Salzen Saüren. Die Firma bringt in den Handel die Lösung des salzsauren Adrenalins, die besteht aus

0.1. salzauren-Adrenalin (Adren. hydrochloricum).
0.7. Kochsalz.
0.5. Acetonchloroform.
100.0 Aq. dest.

Dieses Adrenalin galt lange Zeit als das einzig verwendbare Nebennierenpräparat in Deutschland und ist es wohl auch hier in den U. S. heute noch. Es wurde in Dentschland hervorragend bekannt durch eine grosse Arbeit von Dr. Braun, Oberarzt am Diaconissen Krankenhaus zu Leipzig-Lindenau, der dem Adrenalinzusatz zum Cocain namentlich bei Zahnextractionen deshalb einen hohen Wert beilegte, weil er die Dosis & Concentration des Cocain herabzusetzen die beste möglichkeit biete. In der Tat hat die Local-Anaesthesie durch Cocain allein zu manigfachen Bedenken geführt und Löwen, der Assistent von Dr. Braun, giebt in seiner Arbeit eine ausführliche übersicht über die verschiedenheit der Dosierung des Cocains seitens der verschiedenen Zahnärzte. Die oft unerwartet auftretenden toxischen Erscheinungen und die zur Erzielung wirklicher Anaesthesie notwendige hohe Concentration des Cocain hatten denn auch vielfach zum verlassen seiner Anwendung in der Zahnheilkunde geführt, so dass ein hülfsmittel, mit klein procentigen Cocain-Lösungen Erfolg zu haben, begrüsst werden musste.

Auf welche Weise ist nun die örtliche Wirkung des Adrenalin in Verbindung mit Cocain aufzufassen & worin liegt seine verminderte Gefahr dem Cocain allen gegenüber? Die örtliche Wirkung des Adrenalin ist keine anaesthesirende Wirkung. Ob sie auch genau genommen keine toxische ist. sondern lediglich eine Anaemie erzeugende, Contraction der Gefässe hervorrufende Wirkung, ist noch eine offene Frage. Diese Anaemie bewirkt aber eine Localisierung der toxischen Wirkung des dem Adrenalin beigemischten Cocains einerseits und eine vermehrte anaesthesierende Wirkung des Cocains an der Injections stelle. Durch die letztere Wirkung aber sind wir im stande, die Concentration und Dosis des Cocains herabzusetzen, und darin besteht der grosse Fortschritt, den uns die Nebennierinpräparate in der Local-Anaesthesie in Aussicht stellen. Wenn ich eben sagte, dass es noch fraglich ist, ob die Wirkung des Adrenalin allein eine toxische zu nennen ist, so ist doch die Her-

vorrufung der Anaemie und die Herabsetzung des Blutdrucks nicht gleichgiltig und nicht ohne Gefahr. Denn schon die Ausschaltung eines, wenn auch kleinen Teils des Gefässsystems aus der Circulation ist für die betroffenen Gefässe sowohl, als auch für die unter erhöhtem Blutdruck stehenden umgebenden Gefässe nicht gleichgiltig und die enorme Wirksamkeit der so vielfach verdünsten Adrenalinlösung beweist ja mit welch activen Stoff wir es zu tun haben. Anderseits ist aber selbst die 1%ige Cocain Lösung, allein injiciert, absolut nicht ungefährlich und es steht für mich nach meinen Jahre-langen Versuchen fest, dass es eine grosse Anzahl Patienten giebt, die auf Injectionen 1%iger Cocainlösung mit nicht ganz unbedenklichen Symptomen, wie Gesichtsblässe, Zittern und allgemeiner Schwäche reagieren. Es war für mich deshalb von Anfang an mein Bestreben, mit Injectionspräparaten zu arbeiten, die wo moglich die Gefahren des Adrenalin als auch der 1%igen Cocainlösung im geringerem Grade oder garnicht aufwiesen.

Als Ersatz für Cocain habe ich schon seit Jahren Versuche mit dem von Dr. Ritsert construirtem Anaesthesin angestellt. Ich habe darüber in Central Verein Deutscher Zahnärzte im Jahre 1902 berichtet. Das Anaesthesin ist der Aethylesther der Paramidobenzosäure und ist selbst in grossen Dosen nach Versuchen von Kobert und Ainz ohne toxische Eigenschaften. Es hat sich als Local Anaestheticum in der Augenheilkunde, in der Chirurgie und in der Rhino und Laryngologie bewährt musste aber um eine genügend anaesthesirende Wirkung zu erzielen in der Zahnheilkunde in grossen Quanten injiciert werden, so dass allzu häufig Schwellungen post extractionem auftraten.

Diesem Übelstand suchte der Erfinder abzuhelfen durch Construction eines phenolsulfosauren Anaesthesins das er als "Subcutin" bezeichnete. Meine weiteren Versuche erstreckten sich auf Injection von Subcutin allein und von Subcutin in Verbindung mit Adrenalin.

Über diese Versuche berichtete ich im Jahre 1903 im Central Verein Deutscher Zahnärzte und Konnte von einem grossen Procentsatz von Erfolgen sprechen.

Ich habe im August, September, October 1903 alsdann eine weitere Serie von Adrenalin und Subcutin Injectionen aufgezeichnet, die im Durchschnitt zufriedenstellend ausfielen. Inzwischen haben die Höchster Farbwerke ein Nebennierenpräparat in den Handel gebracht, das sie mit "Suprarenin" bezeichneten und das jetz von Dr. Braun als Zusatz zu Cocaininjectionen verwendet wird. Ich konnte mich bei meiner Anwesenheit in Leipsig, wo Herr Dr. Braun mir in liebenswürdigster Weise seine Methode demonstrierte, von der prompten Wirkung überzeugen. Das Nebennierenpräparat der Höchster Farbwerke wird im Verbindung mit Cocain als Suprarenin-Cocain Tabletten hergestellt die 0.01912 gr. halten. Sie bestehen aus:

0.00013 Suprarenicum boricum
0.01000 Cocainum muriaticum
0.00900 Chlornatrium

und werden in physiolog. Kochsalzlösung gelöst. Das borsaure Suprarenin ist das einzige wasserlösliche Salz des Suprarenin und hat in der festen Form den grossen vorzug der Haltbarkeit. 0.065 g davon gelöst in 50 ccm. Wasser oder physiol. Kochsalzlösung entspricht einer Adrenalin Lösung 1 : 1000. Die Tabletten kommen zu 20 Stück zum Preis von M1-50 durch Apotheker G. Pohl, Schönbrun (Danzig) in den Handel und es ist in der Tat ein sehr handliches Arbeiten

mit diesen zu jedem Fall frisch zu bereitetem in gleicher Dosis vorhandenem Quantum.

So werden denn augenblicklich dem Cocain entweder Adrenalin (Adrenalin hydrochloricum) oder das deutsche Fabrikat Suprarenicum boricum zugesetzt. Adrenalinlösungen werden im Allgemeinen alle Nebennierenpräparaten genannt und neuestens werden dieselben vielfach unter verschiedenen Namen wie Eusemin u a. empfohlen, selbst ohne, dass wir ihre Dosierung und ihr Wirkungsverhältniss zum Cocain kennen.

Ich begrüsste es nach alle diesem mit Freuden, als die lange Zeit im Gange befindlichen versuche Dr. Ritserts zur Herstellung eines weniger toxischen Nebennierenpräparates von Erfolg gekront wurden und möchte Ihnen heute uber meine Versuche mit *Paranephrin Ritsert* berichten.

Das Paranephrin ist der wirksame wasserlösliche, blutdruck steigernde Bestandteil der Nebenniere, der ohne Hilfe von Laugen oder Säuren gewonnen wird. Das Verfahren ist vom Erfinder zum Patent angemeldet. Es unterscheidet sich die Substanz namentlich vom Adrenalin und Suprarennin dadurch, dass es weit geringere Giftigkeit und reizlosere Wirkung ausübt. Die Gewinnung der Letzteren beruht darauf, dass die in den Nebennieren ursprünglich vorhandene wasserlösliche Blutdrucksubstanz durch Alkalien zersetzt in einer wasserlöslichen Form abgeschieden wird. Wohl war es bekannt, dass die frischen Auszüge der Nebenniere weniger reizend und weniger toxisch wirkten, aber man griff doch zu dem durch Zersetzung der natürlichen Substanz gewonnenen Adrenalin, da die Extractlösungen einesteils weniger haltbar, anderntcils auch in ihrem Gehalt an wirksamer Substanz sehr schwankend waren.

Diesem Übelstand hat nun Dr. Ritsert abgeholfen, und es liegt in dem Paranephrin die reine, durch ein Herstellungsverfahren natürliche Nebennierensubstanz vor, welche keinerlei Albumosen oder Peptone enthält. Das Paranephrin wird von der Chem. Fabrik Merck in Darmstadt in zum Gebrauche fertiger, wässriger Lösung mit 0.6% Kochsalz gehalt und im Verhältniss 1 : 1000 in den Handel gebracht. Die Lösung ist ohne Zusatz von Chloreton angefertigt, bleibt haltbar und ist selbst nach monaten noch von der anfänglichen physiologischen Wertigkeit.

Die pharmacologische Bearbeitung des Paranephrins durch Prof. Hinz in Erlangen ist noch nicht beendet. Ich bin aber schon heute in der Lage, Ihnen von folgenden interessanten Versuchen des Erfinders Dr. Ritsert selbst zu berichten.

Bezüglich der toxischen Wirkung ergaben orientierend vergleichende versuche an Kaninchen von annähernd demselbe Gewichte (2,4bis 2,5 Kilo) folgende Resultate: Es wurden beiderseitig subcutan injiciert Adrenalin hydrochlor (1 : 1000) 4,5 ccm. Wirkung: Tier sehr hinfällig; 6 ccm. Wirkung Tod nach 2 Stunden.

Suprarenicum bor (1 : 1000) 4,5 ccm. Wirkung: wurde gut vertragen. 9 ccm. Wirkung: Tod nach ¾ Stunden.

Paranephrin Ritsert (1 : 1000) 4,5 ccm. Wirkung wurde gut vertragen 6 ccm. Wirkung desgleichen; 15 ccm. Wirkung desgleichen Tod trat nicht ein. Ein grosser vorteil der ganzen Herstellung des Präparates liegt in seiner leichten Sterilisierbarkeit und in dem leichten zusatz jeden Local-Anaestheticums zu den Präparat. So erstrecken sich meine Versuche auf die verschiedensten Arten der zusammensetzung, die einnerseits mit dem ungiftigen Subcutin, anderseits mit bis zu 0.5%igen Cocain-Lösung herabgemindert wurden.

(1) Paranephrinlösung (1:1000) Cocain 1%,
(2) Paranephrinlösung (1:1000) Cocain 1%, Subcutin 1%,
(3) Paranephrinlösung (1:1000) Cocain 0.5%, Subcutin 0.5%,
(4) Paranephrinlösung (1:1000) Cocain 1%, Subcutin 0.2%,

sind die hauptsächlichtsten Zusammensetzungen, die Verwendung fanden. Der Zusatz des Subcutins ist namentlich seiner Ungiftigkeit und doch anaesthesierenden Wirkung wegen zu empfehlen und die versuche, die ich damit gemacht, befriedigten mich auch bei diesen kleinen Quantitäten durch das Ausbleiben der früher beobachteten Schwellungen.

Friedländer, Berlin, Spiess, Frankfurt haben in der rhino-laryngologischen Praxis gute Erfolge mit Paranephrin aufzuweisen.

Von Zahnärzten kann ich bis heute die Collegen Hermann, Karlsbad, Mannsbach, Karlsruh, Römer, Strassburg, Schorn, München nennen, die mir mitheilungen über zufriedenstellende verwendung freudlichst gemacht haben.

Prof. Port, Heidelberg hat eine grössere versuchsreihe im Universitäts Institut im Gang und wird dieselbe demnächst veröffentlichen.

Ich schliesse aus der grossen Anzahl meiner Versuche nur die Zusammenstellung von ca. 50 Fällen an, die sich meist durch besondere Bemerkungen als Fälle nicht herkömmlicher Art auszeichneten und füge hinzu dass ich mit der Entscheidung, ob schmerzlos oder nicht stets sehr streng zu Wege ging, um nichts durch Suggestion und die so haüfige momentane Zufriedenheit des Patienten nach Anwendung eines Mittels zu Trugschlüssen Anlass zu geben.

Die Zusammenstellung der 56 Fälle ergibt 40 zweifellose Erfolge, 8 eingeschränkte und 8 Miss- Erfolge, ein Resultat, das das Mittel jedenfalls als ein beachtenswertes erscheinen lässt. Unter Erfolgen habe ich dabei die erzielte vollkommene Schmerzlosigkeit des operationen Eingriffs verstanden. Noch weit aus erfreudlicher ist das Resultat, betrachten wir es auf die Nachwirkungen der Injection hin, die sich in der Rubri Befund am nächsten Tage vorfinden. Ich habe nämlich in allen diesen verzeichneten Fällen den Patienten der Controlle wegen auf den nächsten Tag wiederbestellt und ihn auch dann gesehen und als völlig geheilt und ohne Nachwirkungen constatiert, wenn darüber bei den Aufzeichnungen nichts besonders bemerkt ist. Unter den abnormen Fällen 18 und 19 zeigen alle Fälle einen günstigen Verlauf, ohne nacher auftretende Schwellungen, schwere Heilungen oder dergl. Besonderer Erwähnung bedarf noch der Fall 47, bei dem ich die Injection anwandte, nicht um eine Extraction vorzunehmen, sondern um das sehr empfindliche Abschleifen 2er gesunder Zähne, die ich fur eine Brücke benötigte, erträglich zu machen. Dies gelang auch vollständig. Es stellten sich aber bald nach der Injection so bedenkliche Symptome allgemeiner Schwäche ein, dass ich die Arbeit unterbrechen musste. Ein 2. Versuch am nächsten Tage verlief ebenso. Ich gebe zu, dass es sich hier um ausgesprochene Idiosynkrasie gegen Cocain handeln konnte, immerhin aber wurde durch diesen Fall meine schon mehrfach ausgesprochene Ansicht, von der erhöhten Gefahr bei Injectionen und nachfolgender Resorption ohne das vorhandensein einer Wunde, durch die Blut und die Injections flüssigkeit ihren directen Ausweg aus dem Körper finden bestärkt. Und mit der Möglichkeit dieser erhöhten Gefahr müssen wir rechnen bei jeder Anwendung der Injection behufs schmerz-

	Datum. (*1904.*)	*Patient.*	*Zahn.*	*Präparat.*	*Zahl der injectionen.*	*Zahnfleisch.*	*Wartezeit.* (*Minuten*)
1.	März 17.	M. 40 jahre.	^{1}M.	Paranephrin 1 : 1000. Cocain 1 p. c.	2		
2.	März 16.	Derselbe.	B^{1}.	Keines.			
3.	März 18.	Derselbe.	$\sqrt{M^{1}}$.	Subcutin. Allein.			
4.	März 18.	M. 25 jahre.	M_{3}.	Paranephrin. Cocain 1 p. c.		Wenig weiss.	5
5.	März 19.	F. 25 jahre.	$\sqrt{\overline{B^{1}}}$. $\sqrt{{}^{1}\overline{M}}$.	Paranephrin. Cocain 1 p. c.		Weiss.	
6.	März 24.	F. 22 jahre.	M^{1}.	Paranephrin. Cocain 1 p. c.	2	Weiss.	
7.	März 25.	F. 30 jahre.	M_{1}.	Paranephrin. Cocain 1 p. c.	2	Wenig weiss.	
8.	April 13.	F. 45 jahre.	^{3}M	Paranephrin. Cocain 1 p. c.		Weiss.	5
9.	April 14.	M. 30 jahre.	$\sqrt{\overline{{}^{2}B_{1}}}$.	Paranephrin 1 : 1000. Cocain 1 p c. Subcutin 1 p. c.	2	Weiss.	5
10.	April 15.	F. 35 jahre.	M^{1}.	Paranephrin 1 : 1000. Cocain 1 p. c Subcutin 1 p. c.		Wenig weiss.	
11.	April 15.	M. 25 jahre.	M_{1}.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.		Wenig weiss.	5
12.	April 18.	M. 35 jahre.	M_{1}.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.		Etwas weiss.	5
13.	April 19.	F. 30 jahre.	$\sqrt{{}^{1}\overline{B}}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.		Weiss.	5
14.	April 19.	F. 32 jahre.	$\sqrt{\overline{B^{1}}}$. $\sqrt{\overline{M^{1}}}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.			5
15.	April 19.	Dieselbe.	$\sqrt{\overline{{}^{2}B}}$. $\sqrt{\overline{{}_{1}B}}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	5	Etwas weiss.	5
16.	April 20	M.	$\sqrt{\overline{M^{1}}}$.	Paranephrin 1 : 1000 Cocain 1 p c. Subcutin 1 p. c.	2	Etwas weiss.	5

Quantum.	*Resultat.*	*Befund am nächsten tag.*	*Besondere bemerkungen.*
1 ccm.	Schmerzlose extraction.	Keine nach blutung. Keine nach schwellung.	
	Schmerzhafte extraction.		
1 ccm.	Schmerzhafte extraction v. 3 wurzen.		
½ ccm.	Schmerzhafte extraction.		Sehr festsitzender zahn.
Je eine ccm. linke und rechte seite.	Extraction v. 4 wurzeln schmerzlos.		
⅔ ccm.	Extraction v. 3 wurzeln. Schmerzlos.	Abnahme der vor extraction vorhanden schwellung.	Schwellung wundverlauf sehr normal. Keine nachblutung. trotz frühere blutungen.
2 ccm. bei injection viel verloren.	Schmerzhafte extraction.		
¾ ccm.	Extraction schmerzlos.	Normal.	Fractur und mehrmaliges extrahiren der brüchigen wurzeln.
1 ccm.	Extraction schmerzlos.		Wurzel gespaltetief fracturiert verdickung der wurzelspitze.
1 ccm.	Extraction völlig schmerzlos.		Strappes zahnfleisch schwierige injection.
1 ccm.	Schmerz gelindert.	Nach 3 tagen zahnlücken schmerz.	Strappes zahnfleisch, ungünstige injection.
½ ccm.	Extraction völlig schmerzlos.		Schlechte injections, möglichkeit, innen seite gar keine injection, zahn festsitzend.
¾ ccm.	Fractur und extraction völlig schmerzlos.	Normal.	
1 ccm.	Extraction schmerzlos.	Normal.	Wurzel briechig. Patient sehr ängstlich.
1 ccm.	5 wurzeln schmerzlos extrahirt.	Normal.	Keine blutung.
Aussen und innen je ½ ccm.	3 extraction fast schmerzlos.	Normal.	

Datum. (1904.)	*Patient.*	*Zahn.*	*Präparat.*	*Zahl der injectionen.*	*Zahnfleisch.*	*Wartezeit.* (*Minuten.*)
17. April 20.	F. 17 jahre.	^0C.	Paranephrin 1 : 1000. Cocain 1 p. c Subcutin 1 p. c.	2	Weiss.	5
18. April 21.	F. 35 jahre.	^1M.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	2	Weiss.	5
19. April 25.	F. 32 jahre. Dieselbe wie Nos. 14 und 15.	$\sqrt{M_1\ B_1\ B_2}$	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	4-5	Weiss.	7
20. April 23.	M. Derselbe wie No. 16.	$\sqrt{B^1}$. B^2.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5
21. April 26.	F. 40 jahre.	$\sqrt{{}^1B}$. $\sqrt{{}^2B}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weisslich.	5
22. April 29.	M. 35 jahre.	$_2M$.	Paranephrin 1 : 1000 Cocain 1 p. c Subcutin 1 p. c.	3	Weiss.	5
23. April 28.	F. 35 jahre.	$\sqrt{M^3}$.	Paranephrin 1 : 1000. Cocain 1 p. c Subcutin 1 p. c.		Weisslich.	5
24. April 30.	M. 50 jahre.	$\sqrt{C^0}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5
25. April 30.	M. 35 jahre. Derselbe wie No. 22.	M_2.	Paranephrin 1 : 1000 Cocain 1 p. c. Subcutin 1 p. c.		Nicht weiss.	7
26. Mai 2.	F. 35 jahre. Dieselbe wie Nos. 14, 15, 19.	$_2M$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.			5
27. Mai 2.	F. 23 jahre.	B^1.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.		Weiss.	5
28. Mai 9.	F. 17 jahre.	$\sqrt{M^1}$. M^2.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5

Quantum.	*Resultat.*	*Befund am nächsten tag.*	*Besondere bemerkungen.*
½ ccm.	Extraction vollständig schmerzlos.	Normal.	
1 ccm.	Extraction völlig schmerzlos.	In der nacht herz krampf. Nächsten Tag lückenschmerz. Nach einigen tagen aufhören des neuralgischen schmerzen.	Festsitzender holer zahn. Patientin hat häufig herzkrämpfe. Extraction *musste* geschehen wegen 1 jahr dauernder neuralgie. Nach extraction herzkrampf. Beschleunigter puls. Nach ¼ stunde erholt.
1¼ ccm.	3 vollständig schmerzlose extractionen eingriff mit entfernung v. alveolen sequestern.	Etwas schwellung. Antisept. Behandlung der wunde nötig bis 27 April. Langsame heilung verlauf normal.	Anaesthesie derselben unterkieferhälfte. Brüchige alveolen und entfernen kleiner sequester sofort nach der extraction der putriden wurzeln.
1½ ccm.	2 Schmerzlos extractionen.	Normal.	Demonstration in Zahnärtzlichen Verein, Frankfort a/M. Wurzeln brüchig.
½ ccm.	Wenig schmerz.	Keine schwellung. Normal.	Eiterung am [1]B.
¾ ccm.	Schmerzlose extraction.	Normal.	Aengstlicher patient.
½ ccm.	2 völlig schmerzlose extraction.	Normal.	Ungünstige injection.
¼ ccm.	Extraction schmerzlos.	Normal.	Sehr sensibler patient.
½ ccm.	Extraction schmerzhaft.	Normal.	Sehr ungünstige injection.
½ ccm.	Extraction nahe zu schmerzlos.	Normal.	Festsitzender zahn. Injection ungünstig.
½ ccm.	Fractur. Darauf extraction fast schmerzlos.	Normal.	Sehr festsitzender brüchiger vielfach gefüllter zahn.
1 ccm.	Absolut schmerzlos. Extraction beider zähne.	Normal.	Sehr ängstliche. Sensible patient.

	Datum. (*1904.*)	*Patient.*	*Zahn.*	*Präparat.*	*Zahl der injectionen.*	*Zahnfleisch.*	*Wartezeit.* (*Minuten.*)
29.	Mai 10.	M. 50 jahre.	$\mathrm{I}\diagup\overline{B_2}$. $\mathrm{I}\diagup\overline{M_1}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5
30.	Mai 10.	M. 48 jahre.	^1M.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p c.	3	Nicht weiss.	5
31.	Mai 10.	F.	M_2.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p c.	2	Wenig weiss.	5
32.	Mai 11.	F.	M_1.	Paranephrin 1 : 1000. Cocain 1 p. c Subcutin 1 p. c.	3	Weiss.	5
33.	Mai 17.	M. 45 jahre.	M^1.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5
34.	Mai 18.	F. 55 jahre.	M^1.	Paranepbrin 1 : 1000. Cocain 1 p c. Subcutin 1 p. c.	2	Weiss.	5
35.	Mai 20.	M. 50 jahre.	^1B.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	5	Weiss.	5
36.	Mai 20.	F. 40 jahre.	Fracturirt M_3.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	4	Weiss.	5
37.	Mai 21.	F. 28 jahre.	$_3M$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin.	3	Weiss.	5
38.	Mai 21.	M. 50 jahre. Derselbe wie No. 35.	M_1.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin.	2	Weiss.	5
39.	Mai 21.	F. 35 jahre.	B^1.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin.	2	Weiss.	5
40.	Mai 28.	M. 72 jahre.	B_2.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin.	2	Weiss.	5
41.	Juni 23.	F. 40 jahre.	$\mathrm{I}\diagup\overline{{}_1B\,{}_2B}$. $\mathrm{I}\diagup\overline{{}^1M}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5
42.	Juni 23.	F. 30 jahre.	$\mathrm{I}\diagup\overline{B^1\,B^2}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	3	Weiss.	5

Quantum.	*Resultat.*	*Befund am nächsten tag.*	*Besondere bemerkungen.*
¾ ccm.	3 tiefeingriefen de extractionen völlig schmerzlos.	Normal.	
¾ ccm.	Schmerzgefühl.	Nachschmerz.	8 tägige periodontitis vorangegangen.
½ ccm.	Tiefe fractur, 1 wurzel im kiefer gelassen. Keinen schmerz.	Kein schmerz. Keine schwellung.	Festsitzender zahn.
¾ ccm.	Extraction völlig schmerzlos.		
¾ ccm.	Extraction schmerzlos.	Normaler rückgang des abscesses. Keine nachblutung.	Starker abscess. Gewebe weich.
1 ccm.	Extraction schmerzlos.	Blutung nachts begonnen, und am Mai 19 tamponiert und gestillt.	Bluterin! Keine blutung bis nachts darauf.
1 ccm.	2 malige fractur. Extraction völlig schmerzlos.	Tadellose wunde keine citerung mehr, keine schwellung.	Eiterung und chron. Zahnfleischfistel.
1 ccm.	Schwierige extraction im Kieferwinkel erst schmerzlos bei mehren versuchen eintreten der sensibilitat.	Normal. Keine schwellung.	Keine sichtbare wurzel.
1 ccm.	Extraction fast schmerzlos.	Nachschmerz.	Starke periodontitis. Sehr sensible patientin.
½ ccm.	Extraction der beiden getrennten Wurzeln schmerzlos.		Tief cariöser zahn injectionen lingual nicht möglich.
½ ccm.	Behrührung der freilieg. Pulpa ebenso extraction gänzlich schmerzlos.		Sehr ängstliche patientin. Berührung d. freiliegenden pulpa vor injection sehr schmerzhaft.
½ ccm.	Extraction schmerzlos.		Hoch gradige periodontitis ausgebreitete Anaesthesie des rechten unterkiefers nach ca 1 stunde.
½ ccm.	4 wurzeln und 1 zahn völlig schmerzlos.		Antrums empyem.
½ ccm.	Extraction der sehr schmerzhafter wurzeln ganz schmerzlos.	Normal.	Starke schwellung sehr ängstliche patientin.

	Datum. (1904.)	*Patient.*	*Zahn.*	*Präparat.*	*Zahl der injectionen.*	*Zahnfleisch.*	*Wartezeit.* (*Minuten.*)
43.	Juni 23.	F. 32 jahre.	$\sqrt{{}^{0}C}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 1 p. c.	2	Weiss.	4
44.	Juni 29.	M.	${}_{1}M$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 0,2 p. c.	3	Wenig weiss.	5
45.	Juli 2.	F. 17 jahre.	M_1.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 0,2 p. c	3	Weiss.	5
46.	Juli 4.	M. 36 jahre.	$\sqrt{M^1}$. $\sqrt{B^2}$.	Paranephrin 1 : 1000. Cocain 1 p. c. Subcutin 0,2 p. c.	3	Weiss.	10
47.	Juli 5.	F. 40 jahre.	Gesunder. ${}_{2}B$, M_2.	Paranephrin 1 : 1000. Cocain und subcutin 0,2 p. c.	4	Weiss	5
48.	Mai 28.	F. 20 jahre.	$\sqrt{M_1}$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	3	Weiss.	5
49.	Mai 31.	F. 22 jahre.	${}^{1}M$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	3	Weiss.	5
50.	Juni 1.	M. 35 jahre.	B^1.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	3	Weiss.	5
51.	Juni 8.	F. 25 jahre.	M_1. $\sqrt{B_2}$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	3	Weiss.	5
52.	Juni 9.	F. 27 jahre.	$\sqrt{M^1}$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c	2	Weiss.	5
53.	Juni 21.	F. 25 jahre.	${}^{1}M$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	2	Wenig weiss.	5
54.	Juni 22.	F. 16 jahre.	${}_{1}B$. gesund.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	2	Weiss.	5
55.	Juli 4.	F. 40 jahre.	M_3.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	2	Wenig weiss	5
56.	Juli 5.	F. 38 jahre.	${}_{2}M$. $\sqrt{{}_{1}M}$.	Paranephrin 1 : 1000. Cocain und subcutin 0,5 p. c.	2	Weiss.	5

Quantum.	*Resultat.*	*Befund am nächsten tag.*	*Besondere bemerkungen.*
¼ ccm.	Extraction schmerzlos.		Patientin ängstleieh.
¾ ecm.	Fractur schmerzhaft.	Keine schmerz. Keine sehwellung.	Festsitzender zahn.
¾ ecm.	Schmerz gelindert.	Schwellung weniger.	Schwellung und periodontitis.
¾ ccm.	5 schmerzlose extractionen.	Normal.	Tief sitzende brüchige wurzel.
½ ccm.	Vollständig schmerzloses abschleiffen der gesunden vorher sehr sensibler Zähne behufs brüken er satz.	Normal.	Kurz naeh injection Blässe des Gesichts und des ganzen Zahnfleishes allegemein Zunemende Schwäche, so dase Behandlung unterbrochen werden musste Rückkehr der Farbe und sensibilitat nach 10 minuten.
1 ccm.	Extraction wenig schmerzhaft.		Periodontitis, sofortiges auftretendes nachschmerzes.
¾ ccm.	Extraction völlig schmerzlos.	Normal. Schwellung Zurüek gegangen.	Eiterung, starke schwellung.
½ ccm.	Extraction schmerzlos.	Normal.	Starke periodontitis, beginnender Abscess, geringe Blutung.
1 ccm.	Extraction schmerzlos.	Normal.	Sehr schwierige, 5 malige extraetionen.
½ ccm.	Extraction schmerzlos.	Normal.	Gesicht und Lippen blass, Patientin neight auch sonst zu ohnmacht. (Keine Blutung.)
¾ ccm.	Extraction schmerzlos.	Normal.	Periodontitis.
½ ccm.	Extraetion vollkommen schmerzlos.	Normal.	Gesunder ¹B extrahiert Regulierung Patient anaemiseh. (Keine Blutung.)
¾ ccm.	Schmerz nur gelindert.	Nachblutung.	Periodontitis, sehr festsitzender schwierig zu extrahierender Zahn.
¾ ccm.	$_2$M. völlig schmerzlos $\checkmark_1{}^1$M fast schmerzlos $\checkmark^2{}_1$M etwas schmerzhaft extrahiert	Normal.	

loser Excavierung zu füllender Zähne. Ein Anlass mehr zur Injection nur solche Mittel zu verwenden, die an und für sich eine geringere toxische Wirkung besitzen. Die Paranephrinlösung 1 : 1000 in Verbindung der 1% igen oder noch besser ½% igen Cocain Lösung (Subcutinlösung) dürft ein solches Mittel sein. Von ihrer erfolgreichen Anwendung bei Zahnestractionen Ihnen zu berichten war der Zweck meiner Arbeit. Sie zu eigenen Versuchen mit derselben auch bei anderen schmerzhaften Zarhnärztlichen Eingriffen aufzuforden, ist der Wunch mit dem ich diese Arbeit schliesse.

Das Dr. Ritsertsche chem. Laboratorium in Frankfort A. M. wird jederzeit nach allen Ländern gerne Gratis Proben versenden.

Ich bedaure lebhaft bei diesem grossen und bedeutenden Congress nicht persönlich anwesend sein zu können, um die Wirkung der Paranephrinpräparate zu demonstieren, Ich hielt mich aber für berechtigt gerade diese hervorragende Gelegenheit zu benutzen, Ihnen Kenntniss von diesen Präparaten zu geben, die nach meiner Meinung eine Zukunft haben und geeignet sein dürften. unserer Wissenschaft und Praxis von Nutzen zu sein.

Résumé.

Der Zusatz von Nebennierenpräparaten zu Lokalanaestheticis behufs Erzielung schmerzloser Zahnoperationen ist zu empfehlen, da die anaesthesierende Wirkung dadurch erhöht und die toxische Wirkung dadurch vermindert wird.

In den bis jetzt gebräuchlichen Nebennierenpräparaten Adrenalin (Parke, Davis & Co.) und Suprarenin Hochster Farbwerke ist neuestens hinzugekommen das Paranephrin Ritsert, das eine geringere toxische Wirkung und verminderte Reizbarkeit aufweist.

Als Ersatz oder Zusatz zu Cocain ist das ungiftige Subcutin Ritsert (sulfosaurer Paramidobenzoesaure aethylesther) zu empfehlen.

Fur schmerzlose Zahnextractionen hat Verf. mit Erfolg angewendet die Lösungen Paranephrin 1:1000, Cocain 1% und 0.5% Subcutin 1%, die als Lokal-Anaestheticum fur Zahnärzte zu empfehlen ist.

Proben dieser Präparate stehen zu weiterer Versuchen jederzeit zur Verfügung und wurden von dem Dr. Ritsertschen chem. Laboratorium gratis geliefert. Reflectanten werden gebeten sich in eine List einzuzeichen.

Dr. C. W. RODGERS, Boston, Mass., moved that the Chairman of Section IV recommend to the congress the appointment of a general committee, to be composed of one chairman for each state, the duties of the general committee to embrace the proper instruction of children of the elementary schools in the care of the mouth and teeth—the work to be carried on with the assistance of the respective boards of education; the several state committees to report each year to the National Dental Association. Also that the congress recommend the same committee for appointment by the National Dental Association, so that the work may be carried on without interruption, the general committee to report at the next—the Fifth International Dental Congress. (Motion carried.)

Dr. A. H. PECK, chairman, said: Personally I am much gratified with the spirit in which you have gone into the work of this section and the interest manifested. As far as I have been able to learn, we have had some of the most interesting papers of any of the sections.

The minutes having been read and approved, the section adjourned *sine die*.

Fourth International Dental Congress.

(B)—APPLIED SCIENCE.

(*SECTIONS V—X.*)

SECTION V.

SECTION V:

Oral Surgery.

Chairman—G. V. I. Brown, Milwaukee, Wis.
Secretary—Arthur D. Black, Chicago, Ill.

FIRST DAY—Tuesday, August 30th.

The meeting of this section was called to order by the chairman, Dr. George V. I. Brown, promptly at 2.30 P.M.

The Chairman's address (with illustrations) was postponed until next day, and the section proceeded to the consideration of papers. The Chairman called on Dr. Thomas L. Gilmer, Chicago, Ill., who read a paper entitled "Surgical Training in the Dental School," as follows:

Surgical Training in the Dental School.

By THOMAS L. GILMER, D.D.S., Chicago, Ill.

Surgery of the mouth, face, and jaws is steadily becoming more to be considered an essential part of dental education. Few if any of the dental schools in the United States are without instruction in surgery. Formerly in this country, with one or two exceptions, no dental schools other than those connected with medical colleges gave systematic training in surgery.

By many dentists it is still thought to be a waste of time which could be better employed in the so-called practical branches. This idea is very thoroughly imbibed by a large part of the student body, and not until it has been demonstrated that surgery is as much a part of dentistry as is the filling of teeth will the student become interested in it. It is perplexing to understand the older practitioner who belittles the teaching of surgery in dental schools while he is daily doing minor surgical operations which, had he the training now given students

of dentistry, he could do much better. In addition to this he could extend his usefulness by performing more important operations which now from a lack of broader training he must refer to someone better equipped than himself. It would seem unnecessary to present argument to establish the fact that a knowledge of general pathology and surgery is as needful (perhaps in a somewhat narrower scope) to the practitioner of dentistry as are those subjects to the practitioner of medicine; but if he is to be a thorough, all-around dentist he must in this age know them.

It is true, as often cited, that but few dentists expect to become oral surgeons in the broadest sense. It is equally true that all dentists do not expect to become specialists in orthodontia, but no school could be regarded as doing its duty did it not train its students in the correction of irregularities of the teeth. If dentistry is to maintain itself as a learned profession it must lay a broad foundation of the fundamentals, sufficiently firm to carry a superstructure which will qualify its graduates to practice their calling in the widest possible manner. There are many vexatious questions in dentistry yet unsolved which must be relegated to general medicine for a solution unless we know more of pathology, more of bacteriology, and more of other fundamentals of medicine. A lack of knowledge of these branches of surgery may jeopardize our patients' welfare. The preparation of cavities, the construction of artificial teeth, and the building of bridges could, it is true, be accomplished with a mechanical and artistic knowledge alone; but this knowledge is only a part of dentistry, and besides, most of this work is closely related to or may be the cause of pathological processes from which it cannot be separated in all cases.

From clinical experiences all practitioners know the serious train of pathologic conditions which at times follow the filling of teeth or the insertion of bridges and artificial dentures. A resultant condition may be no more serious or far-reaching than an alveolar abscess, but we sometimes find as a sequence of an alveolar abscess, necrosis involving the whole or part of the mandible, or caries of the maxilla, or empyema of the maxillary sinus, or occasionally a general pyemia. These conditions and many others are familiar to you.

A knowledge of therapeutics and its practical application, and a knowledge of surgical pathology and surgical technique, may and often does prevent the serious complications above mentioned, while giving strength and confidence to the dentist when confronted by such conditions. It may be true that the dentist does not necessarily need such broad knowledge of general pathology as the practitioner of medicine, but he should have a widely diversified knowledge of it in order that he may be equal to an emergency should it arise.

The knowledge which the dentist must possess and which is not necessary to the general practitioner, adds enough to the dentist's college work to make his course equal in extent to the curriculum of most medical schools. If the dentist be wise and serve his patients to the best possible advantage, he will not utilize his knowledge to the extent only of making a careful examination of the teeth to discover disease in them and the immediate adjacent tissue, but will go over the entire oral cavity, and if he have sufficient knowledge of surgical pathology he may by early diagnosis ofttimes save the pa-

tient much suffering and perhaps his life.

The tongue, the salivary ducts, the mucous membrane, and every part of the mouth should be as frequently and thoroughly examined as the teeth. It is well known that many benign growths in the mouth if neglected often assume malignancy, which by early attention may be prevented; hence the importance of careful and frequent examination of the dentist's field. Many patients do not know of the danger, and in fact may not be cognizant of the condition until their attention is called to it by the resultant inconvenience, at which time it may be too late to effect a remedy.

Surgery may be defined as a mechanical performance intended to relieve the body of a pathologic condition or injury, hence if the dentist be well versed in pathology and bacteriology and in the fundamentals of general medicine, he is by virtue of his mechanical training well equipped to practice surgery. The technique which he has acquired in operative dentistry qualifies him in a high degree to perform surgical operations in the mouth. Very few surgeons have the manual dexterity to fit them for delicate operations in the mouth, and a great number of those who have do not contemplate with pleasure oral surgical operations, and it is quite certain that all operations in the mouth would soon be relegated to the dentist did the surgeon have confidence that such operations would be as well done by him as are operations on the nose by the rhinologist, or as are operations on the eye by the ophthalmologist.

At this point the question arises, To what extent may the degree "Doctor of Dental Surgery" legally qualify one to practice oral surgery and not render the dentist liable under the medical practice act? Some are of the opinion that no one is under the law qualified to practice surgery who does not possess a medical degree. No case, so far as the writer is aware, has been passed upon which gives an answer to the question, and until a ruling be rendered no definite answer can be given. However, it would seem that since dentistry has a standing before the law as a profession—there being statutes governing its practice—a decision regarding this matter must be reached through an examination of the curriculum of the dental schools, as surgery is as much a part of the dental curriculum as is operative dentistry. Dentists, then, may perform legally any surgical operations which are taught in the dental schools. Certainly the law would demand that anatomy, physiology, chemistry, histology, general pathology, surgical bacteriology, and materia medica, in addition to surgical technique, be comprised in the curriculum leading to surgical training, since these branches all combined comprise surgery. If under the law the dentist may practice surgery, what then is his legitimate field? With the three-year course surgical work in dental schools has necessarily been abridged. The heads of other departments in the schools are sure that more time is necessary for the presentation of their particular subjects — a contention which is granted; therefore the time remaining for surgery is inadequate for a thorough presentation of the subject. The field would seem to cover the mouth, face, and jaws, and extend as much farther as the pathologic conditions originating in this field may have developed; however, it would be wise for the dentist to call other specialists to his assistance in instances where the conditions carry him into parts

which are the legitimate field of the ophthalmologist, rhinologist, etc.

I am of the opinion that the entire course of surgery should not be concentrated, as is the custom in this country, into the senior year; the subject is too comprehensive. The principles of surgery as well as a part of surgical technique should be taught in the junior year, leaving clinical and operative surgery mainly for the senior year. Together with the principles of surgery, a course on the cadaver is very desirable, as it not only keeps the student's mind familiar with anatomy, but increases his interest in surgery, for unless interest in the subject is stimulated he feels that it is not one of the important parts of dentistry and consequently never acquires a full knowledge of it.

To be more specific, the junior year should include surgical bacteriology in its relation to inflammation, sepsis, asepsis, and antisepis, and the treament of inflammation. It should also include wounds, the healing of wounds with regeneration of tissues, instrumentation, suturing and suture materials, and the application of dressings, and bandaging. On the cadaver should be taught ligation of bloodvessels, tracheotomy, resection of the jaws and nerves, also Gasserian ganglion operations. This course would bring the student to his senior year fully equipped to comprehend and enjoy a course in clinical and operative surgery. To accomplish this work will require two lectures a week throughout the course. In the senior year not less than one lecture and one clinic a week is necessary to properly bring the remaining portion of the subject before the student. The following subjects should be covered by lectures and exemplified in clinic during the senior year, the order to be, viz: Extraction of teeth, including impacted teeth; fractures of the bones of the face and jaws; dislocations; ankylosis of the jaws; resection of the roots of teeth for the cure of persistent alveolar abscess; implantation, replantation, and transplantation of teeth; surgical treatment of alveolar abscess, caries, and necrosis of bone; diseases of the maxillary sinus; aneurisms; resection of the jaws; resection of the branches of the fifth nerve; Gasserian ganglion operations; surgical diseases of the tongue and mucous membrane of the mouth, with diseases of the lips; surgical treatment of actinomycosis, cleft palate, and hare-lip operations; tumors and cysts of the mouth and jaws. I arrange the course in the foregoing order, placing extraction of teeth and removal of impacted teeth first because it is desirable that the student may have an opportunity early in his senior year to gain practical experience in the infirmary, so that by the close of the term he will be better qualified to perform this work in his practice. Concurrently with this course, and commencing with it, the administering of anesthetics should be exemplified on animals and on human subjects in the clinic.

The clinic should be held preferably in a well-equipped hospital; certainly at least a part of the course must be held in such a place, both for the safety of the patient in cases which require confinement in bed for several days after the operation, and for the benefit of the student. However, for the majority of cases a well-equipped surgical infirmary will suffice. This infirmary should be used for no other purpose whatsoever, and be kept scrupulously clean. It should be equipped with all modern surgical appliances needful for our work, including appliances for aseptic work, such as steril-

izing apparatus, etc., for the benefit of the patient and to demonstrate aseptic surgery. At these clinics there should be present at least one surgical assistant, an anesthetizer, and one or more surgical nurses. In addition to these as many students should be drawn from the class each week as can be accommodated, in order that they be given a closer observation of the procedures. All of these assistants and students should be "scrubbed up" and gowned in sterilized gowns, no matter how trivial the operation. These precautions should be observed even in the most minor cases, for the moral effect if for no other. In connection with this infirmary there should be a recovery room, with suitable beds, etc., where patients may remain until in a safe condition to depart. Students who have watched the operations should have patients consigned to them for future treatment under proper supervision, should treatment be necessary.

Printed examination blanks should be filled in by the student under the supervision of the chief assistant to the surgeon, giving a history of the result of the case, with examination and diagnosis. The surgeon then makes his examination and corroborates or corrects the former diagnosis and performs the operation, the patient having been previously prepared. At subsequent clinics the patient should be exhibited to the class. When a student has had a patient from the beginning, witnessed the surgeon's examination and the operation, and has taken the patient through the subsequent treatment, he is in a measure qualified to take charge of similar cases in practice.

I would urge that greater time be devoted to minor surgical operations such as the dentist may encounter every day in his practice, and less time be devoted to the more serious operations such as the Gasserian operations, cleft palate, and hare-lip—operations which must as a rule go to the specialist in oral surgery or to the general surgeon.

A technical course in the manufacture of splints and other appliances for the treatment of fractures of the jaws should be given to more fully equip the student in this work.

At no time in the surgical course should the student be permitted to believe that he is being taught anything but dentistry. He should have it inculcated in him that each chair is teaching him dentistry pure and simple, and that none of the subjects can be omitted and he become a well-rounded practitioner. He should be made to feel that his standing may be established or seriously injured at the outset of his professional career by ability or inability to properly care for a fractured jaw, diagnose and treat a case of empyema of the maxillary sinus, or differentiate between caries and necrosed bone.

In conclusion I would suggest that when practicable, the teaching of oral surgery should be done by one who has had experience in the practice of dentistry and who also has a medical education, as this combination better fits him for the work of teaching the subject. The general surgeon may be well qualified to teach the principles of surgery and the more serious operations before referred to, but from lack of experience in the dentist's field he cannot be as efficient a teacher as one having knowledge of the special pathology of the teeth and jaws and the technique which is gained by constant oral operating.

Discussion.

Dr. N. S. Hoff, Ann Arbor, Mich. The only point upon which I might possibly differ with the essayist is as to whether the man who teaches oral surgery should be a medical man or a dentally educated man, and I do not intend to differ seriously with him on that point, as something can be said upon each side of that question.

I once asked a surgeon who was eminently successful with his work, to what he attributed his success. He answered, "I am a good physician." He was not known as a brilliant operator, but his answer gave me the clue at once to the reason for the success of his work. He knew how to take care of his patients after he had operated upon them. He knew how to diagnose his cases in the first instance. He may not have been as dextrous in manipulative skill as some others, but he knew how to perform his operations, and afterward to exercise care commensurate with the gravity of the operation.

To illustrate my remarks practically, I want to relate the conditions under which we are operating in our school, and thus convey to you some suggestion of what my ideas are in relation to this subject.

Our oral surgeon is a medical man, not a dentist at all. He is a man who is very much interested, however, in our work and has informed himself upon everything that our literature contains in reference to the practice of oral surgery from a dental standpoint. He, however, lacks the technical training of the dental man, and does not attempt to teach that portion of the subject.

We have recently organized our surgical department upon a new basis, with this medical man, who is an excellent surgeon in general practice, as the chief. He has as assistant a dental man who is also a full professor in the faculty and a man of good training for the work. He is known as the therapeutic man. The work is divided so that the dental aspect of the subject is treated entirely by the latter gentleman.

To more completely organize the department we have established a course in pathology, beginning of course with bacteriology and histology—the bacteriology and pathology from the laboratory standpoint being in the hands of another teacher—so that we have three teachers comprising the surgical faculty.

The course of study is given by lectures on oral surgery and the principles of general surgery by the medical man, and the practical oral surgery also further extended by the clinical demonstration. This is supplemented by a laboratory course on the cadaver given under the direction of the general surgeon, which has been given until now with the assistance of his associate who is a medical man; but this year the course will be given with the assistance of the dental man who has charge of our laboratory course in oral pathology.

We feel that in this way we are going to connect our medical man with our dental therapeutics, and his part of the work is also of the dento-surgical order; his work also includes operative procedures in connection with diseases of the pulp and their sequelæ, alveolar abscesses, and work of that sort, together with clinical demonstration of the administration of anesthetics, the extraction of teeth, and the ordinary dental surgical operations.

These three men being organized into

what you might call one faculty, they work together, teaching the general surgical principles of pathology and therapeuties and the general treatment of the subject largely from the dental standpoint. The operation which falls to the dental man he looks after himself; the operation that falls to the general surgeon is looked after by him, and we hope in this way to get the benefit of the wider knowledge and experience of the general surgeon and also the wider knowledge and manipulative skill of the dental surgeon, and combine it by practical laboratory work.

This, in brief, gives my idea of what may be done to organize a course on what you may call a high, practical basis.

I concede it would be very desirable if it were possible for us to have a dental man medically educated—that is, equipped with medical knowledge, not merely a medical degree. I do not think that the mere possession of a medical degree necessarily fits a man for doing this work. A degree might mean little or nothing, but I feel that the practice or technique of the medical man who has given his attention to general and regional surgery is very much more valuable, especially if he be in active medical practice, as he will understand the treatment and handling of surgical cases not only from an operative standpoint but from a medical one as well. I do not believe that the dental man who has practiced dentistry exclusively can have the same command of the situation that the medical man has. Whether it is possible to make these men work in such close touch and in such harmony as to constitute one grand oral surgeon remains to be seen. It is an experiment we are trying, and we hope it is going to succeed, and believe that it will, because these three men are very warm friends and work agreeably together. Each man has his work outlined, and each has agreed to work into the hands of the other. We hope by this process to make a composite oral surgeon, if you please.

In most of the dental schools this work is entirely in the hands of medical men; that is unfortunate, because, as a rule, the medical man does not grasp the subject from the dental standpoint, and that is the point we are more interested in developing.

I was very much interested in the idea expressed in the paper that in teaching this subject we must not forget the ordinary surgical operations, for every lesion about the mouth which is associated with pathogenic conditions involves an operative procedure. I think it is absolutely necessary that if one man is entrusted with the teaching of this subject that man should be a dentist. But where a faculty can be organized in the manner in which we are trying to organize at Ann Arbor, I do not see any reason why we should not make use of the broader skill and experience of our medical *confrères*.

Dr. John S. Marshall, San Francisco, Cal. I heartily concur in the position taken by Dr. Gilmer and with his recommendation as to teaching oral surgery. I would, however, go a step farther than he does. I have always felt, ever since I have been a teacher of oral surgery, that not one-third of the time is given to the teaching of this subject that its importance demands. I have pleaded with the faculties with which I have been connected for more time in which to teach oral surgery, and I have frequently said that no class of students receiving but one lecture a week during the term could comprehend the subject

or understand the value of a good knowledge of oral surgery. They can get in that length of time but a very imperfect idea of the technique even of operations, and I have always felt greatly handicapped in my work on this account. If I could have had three lectures and one clinic a week in teaching oral surgery I think I could have done something. The importance of this branch is not appreciated either by our faculties generally or by the profession at large. When we take into consideration the fact that the dental surgeon has the earliest opportunity to see the various oral lesions, and especially those which are malignant in their tendencies, at a time when an operation would be of the greatest benefit, it is greatly to be deplored that so few dentists understand the pathology of these lesions sufficiently well to be able to diagnose them correctly. As a result our patients frequently suffer the gravest consequences, even to the loss of life in some cases.

You know Garretson says in his "Oral Surgery" that he believes in classifying as malignant all forms of tumors of the mouth which he cannot diagnose as being positively benign; and that, gentlemen, is the only safe way to handle any of these lesions or neoplasms of the mouth. I believe I succeeded better in my work in Chicago on that line of practice than any other. I have frequently removed growths which other men said were benign and might not do any harm, appreciating that the tendency of all benign growths in the oral cavity is toward malignancy. The dental surgeon often makes the mistake of trying to remove those conditions by using caustic and remedies of that kind which only set fire to the tinder, so to speak, thus hastening the malignant aspect of the growth, when if he had realized this tendency at once and recommended the knife he might have saved the life of the patient.

I have been hoping for a good many years that the faculties of our dental schools would take cognizance of the fact that oral surgery is an exceedingly important part of our dental teaching, and I believe that when the time comes that our schools begin to teach oral surgery as it should be taught, the general surgeons will be only too glad to turn over all that class of work into our hands. I have frequently heard some of our best surgeons say that if they had confidence in the ability of dental practitioners to handle these cases they would gladly turn the cases over to them. Surgeons deplore their lack of manipulative ability in the mouth, and say that the dentist can do more in a minute in an operation about the mouth than the average surgeon can in half an hour, because of the superior manipulative ability of the dental practitioner. In dental practice we are using delicate instruments all the time, and get to be very expert with the fingers. You perhaps have noticed the general surgeon at work in the mouth, and how clumsy he seems to be about it. Does not even know how to get his fingers in the mouth so as to expand the cheek and secure space sufficient to be able to see what he is doing. The dentist becomes expert in oral manipulation, and if he has the training from a surgical standpoint to enable him to do that sort of work he can far exceed the skill of the general surgeon in this department of operative surgery.

I greatly hope that the time will come when all of this work will be relegated to the dentist, to whom it belongs.

Dr. W. J. Roe, Philadelphia, Pa. The question is frequently asked: What is

the province of the dentist in relation to oral surgery? It is difficult to give a clear, decisive answer to that question, but—as Dr. Gilmer has so well said—I believe it is proper to frequently impress upon the members of the class that we are teaching them dental surgery, and not trying to make oral surgeons or specialists in oral surgery out of them: that the knowledge we seek to impart is for the purpose of making them able to recognize and relieve all lesions of the oral cavity, whether from traumatism or as the result of pathogenic processes—to recognize these conditions in their incipiency, because we know that the patient goes to the dentist first in such cases, and frequently has been under the care or observation of the dentist for months (without receiving any proper suggestions with regard to the course of procedure and treatment) before the true nature of the condition is recognized.

It is along that line that we should emphasize the province of the dentist. The dentist should be as familiar with oral lesions—their etiology, symptoms, and diagnosis, and the proper treatment—as is the general surgeon or the surgical specialist with those appertaining to his department. When the patient presents himself with a lesion of the mouth, no matter whether from accidental causes or from disease, the dentist should be able to recognize it and warn the patient of the necessity of treatment and also to outline briefly the proper course to be followed. It is not a question of whether there is any great necessity for operation upon the Gasserian ganglion or of other technique of procedure in the graver operations, but there are other operations which are imperative, and which under conditions of emergency the dentist might be called upon to perform, such as a ligation or tracheotomy.

Dr. Rudolph Weiser, Vienna, Austria (honorary chairman of the section). In many respects you are working in the right direction. Before I began the study of dentistry I first received training as a general surgeon, and I am convinced that in order to perfect the general surgeon in manipulative ability it would be well to begin to exercise the hand in dental practice preliminary to taking the course in general surgery; and this is especially true with reference to operations in the oral cavity.

The course in the dental colleges should be extended so that the student may have ample time for a training on broad lines—just as the Commission on Dental Education of the Fédération Dentaire Internationale has declared that it will be necessary to extend this course to four years. I believe this will be a sufficient time in which to prepare students for dental work and fit them for oral surgery. I repeat that I have often thought I would have become a much better surgeon had I first had an opportunity to practice dentistry previous to my surgical course.

Dr. G. V. Black, Chicago, Ill. I regard this subject as one of very high importance and very closely connected with our work, because in the general order of things the dentist first sees these pathologic conditions in the mouth; the sufferer first comes to the dentist, and the dentist should be able to recognize the conditions at sight.

On the other hand I do not suppose that we will ever be able to make successful oral surgeons of all dental students, and it will be only the men who specialize that will become what may be properly termed oral surgeons. In order to obtain

this result, dental education as is now given should be supplemented by such a course as is required for the M.D. degree.

I care not about the *degree*, it is the *knowledge* that forms the basis of the degree that is the important thing. The dentist may perfect himself in oral surgery without possessing the degree of M.D., and he will be recognized at once. There is no difficulty on the score of recognition.

The most important point, it seems to me, that has been partially brought out here, is that students shall have such a course as will enable them to recognize or diagnose all lesions in the oral cavity. One of my students came to me and said he had found a case of hypertrophy; there was a small, tender area under a plate that a patient had been wearing four years and my student wanted to know what to do with it. I looked at the case; it required only a glance to know what it was. I said, "Take the probe and go into that sore and see what you find; go into it thoroughly." He thought it was a neoplasm. He afterward came to me with an impacted canine which he had found under the swelling.

Now, these young men should have such a course as will enable them to recognize such lesions. This is more important than the acquirement of manipulative ability to operate; for, as a general thing, if a man becomes able to recognize the character of disease he can learn the proper method of procedure. What we wish today is to store the minds of our young men with such knowledge that patients may be safe in their hands.

Dr. Arthur D. Black, Chicago, Ill. There is just one feature of the paper regarding which I would like to speak. Dr. Gilmer referred to the fact of the desirability of the technical course in connection with the teaching of oral surgery. I would call attention to the manner in which such a course is carried out in our school under his direction, particularly in connection with the treatment of fractures. We have taken a number of plaster casts which were made by the students in their prosthetic work, sawed them apart and reconstructed them in such positions as they might be found in cases of fracture; then Babbitt metal models have been made of both the upper and lower dentures and mounted on occluding frames. These Babbitt metal models of the jaws in the displaced positions are given to the students in a number of different forms, as illustrative of different fractures, and the students are required to take impressions and make plastic models, reconstructing them in proper occlusion, and then make splints for them in the laboratory. This is such a case [indicating model] made by one of our students. They are also required, on other Babbitt metal dies mounted in proper occlusion, to drill holes through the interproximal spaces and wire the upper and lower teeth as they would be wired in the treatment of fracture cases, and when a student has a case of fracture placed under his care in the clinic he is required to make plaster models of such a case. If it is a case where he wires the teeth, the casts are made and those teeth are wired on the model in exactly the same position as they are wired on the teeth for the patient.

Thus, even before students have an opportunity to handle cases in the clinic or in actual practice, they are enabled to acquire a good technical knowledge of the treatment of fracture cases, and when

a student has handled two or three of these model cases in school work he is certainly much better equipped to handle similar cases when they come to him in his practice later on.

A question has been raised in this discussion as to whether a man with an M.D. degree, or with a D.D.S. degree, or with both degrees is the best man to teach oral surgery. It might be interesting to know in this connection that twenty-six of the men who are teaching oral surgery in the dental schools of this country are M.D.'s, while fifteen have both the M.D. and D.D.S. degrees, and four have the D.D.S. degree only.

Dr. Weiser. I desire to take the liberty of adding a word or two on this subject which the cases here presented bring to my mind. They remind me of a case which I had just before coming over to America. A man had sustained a fracture of the mandible and also of the maxilla, which was broken into two fragments. He was treated immediately after the accident by a very excellent surgeon, but with indifferent success. In fact, this case of fracture was something lying between the fields of surgery and dentistry; it was too unimportant for the surgeon and too surgical for the dentist. The condition in which I found the mouth of the patient when presented to me was deplorable. I found that the first thing to do was to bring that mouth into a hygienic condition. Innumerable splinters of asphalt pavement had to be removed from beneath the mucous membrane of the lower part of the vestibulum oris, and after taking an impression of the upper and lower jaws I was able to treat the case properly by replanting the lost upper right central incisor with the anterior plate of its alveolus by means of silver caps which did not at all interfere with the occlusion.

Such cases remind me of my belief that it is impossible to bring men to study medicine four, five, or six years and then take a three-years' course in dentistry. That would be too difficult to accomplish, but it would be possible to arrange for a fundamental course of perhaps three or four years in the general subjects common to both medicine and dentistry, which would enable one to become a specialist either in dentistry or in surgery. And if a man educated in this way wishes first to become a dentist he would have the foundation to make of himself also a good practitioner of oral surgery.

On the other hand one must remember that general medical and special surgical studies must necessarily be included in the curriculum of the oral surgeon.

Dr. Vida A. Latham, Chicago, Ill. We do not expect the dental student to be a dental surgeon unless he has the elementary training in pathology and its allied branches. Can a dentist recognize an hypertrophied condition in the mouth unless he knows the general structure of the tissues in the mouth and their relations in the oral cavity? Take the surgical part of the work; I believe that he should have a basis for that. The best way, in my opinion, is to teach him dental histology and pathology, so that he thoroughly understands tooth-structure and the soft parts of the oral cavity.

In this course I believe we need to be made more familiar with all parts of the human body, but we should have a special dental histology and pathology course taught by those competent to give a more thoroughly equipped one than we are having at present and by one who knows our practical needs.

The study of neoplasms and other pathologic conditions should be well brought out; then turn the attention of the student in the direction of surgical, pathological, and clinical work and let him study the general principles. Let him take a piece of silk floss, or wire, or catgut and teach him to form sutures, and to tie the different varieties, and when to use them. See that he has a knowledge of the different uses of catgut and silver wire, and when his fingers have become skilful he may take up some work upon the lower animals; then let him assist in surgical clinical work and afterward act as assistant to a surgeon. Most of the boys attending our schools do not care about histo-pathologic work, and the unfortunate circumstance about it is that they are not encouraged or called on to do enough work—and that has been a very common failing in the dental colleges, as students are given too much mechanical instruction in the course, to the detriment of a scientific training.

Let us resort to our pathology, so that our manipulation of an alveolar abscess will begin at the moment of the appearance of the infection in the mouth. I have emphasized that repeatedly. I have had occasion many times to illustrate these conditions to my patients in order to get them to seek relief from the condition present.

Our oral surgery text-books—where are they? Our dental text-books—where are they? We have nothing but a rehash from morning until night. The books written for us today are not scientifically correct on the subject of dental pathology. When, a short time ago, I looked up in Wedl, Bödecker, and Römer the subject of neoplasms of the tooth-pulp I found them classed as tumors of the pulp, while they are really polypi, hypertrophies, or myxomas. Our terminology is very faulty. If you speak of a tumor of the mouth, let it be a tumor in the correct sense of a neoplasm—pathologically so meant—and not an abscess or a swelling of some sort. If you say tumor of the mouth, as a sarcoma, or epithelioma, or carcinoma, follow it up by its terminology and then the student will know what he is looking for and what he is working on.

As long as we get a lax kind of service from our oral pathologists anything is good enough for dentistry. I think our dental college work should be purely medical for the first two years, and dental work and purely practical work in lines of both medical and dental practice for the remainder of the course. We say we have nothing to do in our fourth year—or third year. Let those who have that conception study oral chemistry, bacteriology, anatomy, pathology, and surgery, then ask a man to get up an original thesis; we would then have better-trained men.

Dr. A. Hamilton Levings, Milwaukee, Wis. The difficulty of teaching oral surgery to dental students in my own classes I have found lies in the fact that the dental student in our school is not required to give the same time to anatomy, histology, and pathology as is the medical student. In place of those studies they are given technique, which I believe occupies nineteen hours per week, so that the students begin to think their work is largely mechanical. When you attempt to teach these students oral surgery based upon anatomy, histology, and pathology, you have to go into the rudiments or they do not understand.

I was very much interested in Dr. Gilmer's paper, but it seems to me that

he goes too far. In fact, a man who practices dentistry—a man who works at the chair and intends to make his living by operative work—never can perform successfully the major operations which the essayist mentions. He never will have the technique; never will have the experience; never will have the moral or physical courage to operate upon the Gasserian ganglion, to perform tracheotomy, to attack the branches of the fifth nerve, or the major vessels supplying the face or the mouth.

The operations are difficult and require constant practice in surgery. I do not try to impress upon my students the technique of the resection of the jaw, or the operations for the removal of the Gasserian ganglion, or the resection of the tongue, but I try to instill into their minds the etiology and pathology of the conditions which we find. Now we all know that the majority of patients with pathological processes in the mouth and jaws come primarily to the dentist, and it is the dentist who should be able to recognize the importance of the condition; then if he cannot or is not disposed to treat it he can direct the patient to someone who will. The first recognition or diagnosis of these processes should come from the dentist, because he is the man who will first see them. It seems to me that the teaching of dental surgery today should be along this line. Students should be taught the pathology and symptomatology of these processes, and when you have done that, as Dr. Black has said, you have practically completed the subject.

Dr. T. E. Carmody, Denver, Col. I would like to go back a little farther than some of the gentlemen have, and say that our students are made to take up the study of pathology before becoming reasonably familiar with normal physiology, and, as one of our prominent physiologists says, "pathology is simply physiology gone astray." To know well physiology and pathology, and to be able to diagnose their cases correctly, equips them for the practice of dental surgery and enables the dental practitioner to become a successful oral surgeon provided he have the other qualities requisite to the practice of that department of our work. Every physician does not succeed in surgery, neither should every dentist try to be an oral surgeon. I think if we teach the main diagnostic points, those who wish to follow the subject farther can take the extended study later.

The Chairman. I would like to tell you briefly, how we at the University of Iowa hope to meet the questions that have been raised today. In the teaching of oral surgery, I have found, as you all have, that no matter how you arrange these considerations in your mind, you are dealing with two distinct and very practical questions. Where shall the line of demarkation be drawn between operations that should be performed by the dentist, and those which should be exclusively the work of the surgeon?

For the last year or two I have given clinics at the hospital where we perform all the major operations; and operations of that character can only be done properly and safely in a hospital surrounded by the conditions which prevail there. Moreover the peculiar elements which are impressed upon students through witnessing the procedures of the operator and his assistants in hospital work are in the highest degree beneficial.

We found that this practice was giving the students a one-sided and disconnected sort of education, because they

received purely dental instruction on the one hand and surgical hospital instruction on the other; there was an interval between the two that was not filled. To overcome this we have fitted up a room at the college equipped in every way as a hospital would be, having also facilities for the care of the patients after operations, so that patients can come to the college and have minor operations performed in a proper place by students under our direction, and we hope by this means the student will be properly trained to do those things that he ought to do, and still not become narrow.

Dr. Gilmer (closing the discussion). I am obliged to those of you who have so kindly discussed my paper. Of course the paper generalized a good deal, but when you read it I think you will find that it has covered pretty much the ground in which you have specialized. I am very much obliged to Dr. Arthur Black, who so kindly gave me credit for the course in the treatment of fractures; but really the credit belongs to him, because he suggested it to me and has carried out the idea in conjunction with my work.

Adjourned until 2.30 p.m. Wednesday, August 31st.

SECTION V—Continued.

SECOND DAY—Wednesday, August 31st.

The section was called to order promptly at 2.30 P.M., Dr. George V. I. Brown in the chair. Hon. Chairman Dr. Rudolph Weiser of Vienna, Austria, having been called upon to preside,

Dr. G. V. I. Brown, the chairman, read his address, which was illustrated by a large number of lantern slides.

Chairman's Address.

"In my Father's house are many mansions." Likewise upon earth, in the house of our mother "Medicine" there are also many mansions, and to one of these, the one we all recognize with pride as the home of our own upbuilding—a structure reared by the patient self-sacrifice of loyal dentists who laid its foundation within the shadow of the walls of older medical institutions in the still recent past and from whom the work of its continuance has come down to us as a sacred trust in the fulfilment of which we have gathered here today from the far corners of the earth, to be united under the roof-tree of our own special science—to lay each of us upon its altar the dearest treasure of his latest thought, and in the common spirit that animates us all, for the time lifting beyond the limitations of speech in language other than our own, to establish new records for the guidance of our *confrères* in the relief of human suffering—it is thus my great privilege, as chairman, to give you welcome to the Section of Oral Surgery.

We know Garretson must be in our midst today, and that round about him stand other noble men who have stepped aside from the duties of the dental and general surgeon to contribute something useful toward the development of the science of oral surgery; yet, much as we might incline to eulogize and to dwell upon the individual benefits conferred, it is not so much with these as with the legacy they have left us that we are for the moment concerned.

It would seem to be my duty also, as your chairman, to call attention briefly to those most important considerations which, being of vital interest to the special surgical field we represent, should receive at this time your best attention—that the Fourth International Dental Congress may by the consensus of opinion here expressed establish and define a position for future guidance.

With this in view, my subject naturally divides itself into three heads:

First, The relation of oral surgery to general medicine and surgery. Second, The line of demarkation between those operations properly belonging to the oral surgeon and those outside of the field of

his best usefulness. Third, The most urgent need of advancing both the standing and the usefulness of this work, by definite diagnostic systems.

Inheritors and partakers of the priceless gifts conferred by Priestley, the discoverer of oxygen, John Hunter, the anatomist, Harvey, the physiologist—discoverer of the circulation of the blood, Simpson, the discoverer of chloroform, Pasteur, father of bacteriology, and Virchow, of pathology, all of whom, with a legion of others, are almost as much akin to us as Wells, the dentist, discoverer of nitrous oxid, know that oral surgery is in no respect different from any other branch of medical or surgical practice, except with regard to the special field of operation and nature of certain operative procedures, and is therefore a branch of the parent medical tree.

Like ophthalmology, otology, gynecology, orthopedics, or other generally recognized special divisions of practice, oral surgery has its own characteristic features, yet, in common with them, depends for its basal principles upon pathology, therapeutics, and surgical methods gleaned from the broad teachings of medical science.

In order that each division of the subjects prepared for the program might have presentation from the highest and best source obtainable, practitioners of dentistry and medicine have been invited to contribute, without any line of distinction; and indeed, no such line could be recognized without seriously crippling the scientific value of the section.

We find two distinct classes of practitioners sometimes arrogating to themselves the title of oral surgeon: the one, for want of surgical training, confining his operative efforts to minor surgical operations quite within the province of the daily practitioner of dentistry; the other, with broad knowledge of general surgery but little or no dental training, performing major operations skilfully, but many other operations—perhaps of less degree, though no less important—either not at all or very imperfectly.

One attempting to limit his practice to oral surgery finds the scope and nature of his work but little understood in professional ranks, and naturally much less among the laity. Further, he is more or less in danger of undertaking too much, and therefore laying himself open to criticism on the ground that he can rightfully claim no special fitness for operations too far removed from his own anatomical division, or of doing too little, and thus meriting respect from neither dental nor general surgeons.

A study of the text-books on oral surgery will prove them—with a few notable exceptions—to be divided into these two classes, and the teacher of oral surgery often finds himself sorely puzzled to know just how extensive to make his course.

Having for several years past devoted myself entirely to practice limited to diseases and deformities of mouth, face, and jaws, the only practitioner so far as I have been able to learn who does this exclusively, my practice made up almost entirely of patients referred by practitioners of general medicine, dentistry, or some one of the other special medical branches of practice, I trust to be able to outline from practical experience the several classes of operations that are most readily recognized as being in line with the fitness of one undertaking the work—and to explain why this is so.

It is hoped that the published results of this meeting will give to the world a new conception of the wonderful progress and the surgical possibilities of our special

field, and the aim in preparation of the program has been to bring out by practical representation the results in each of the chief divisions, in order that a full and creditable showing may be made in the published Transactions.

To this end, and further to emphasize the need of more carefully established rules for diagnostic guidance, I have chosen to illustrate a number of cases from my practice [see page 172 and Plates I-XII] and to give both ante-operative conditions and post-operative results, some of these being of special interest because of similarity of objective symptoms, while the etiologic factors are entirely different.

In the evolution of every science there is a period of empiricism which holds almost undisputed sway. Conclusions are reached, statements made, advocates of one theory or another are roused into activity, each in turn to be displaced by the slower, sounder conclusions of scientific research.

No better example of this could be found than is evidenced by the progress of dental and oral surgery during the last decade, but on every hand today there is a growing intolerance of theoretical proposition unbacked by the weight of absolutely unimpeachable results in both clinical and laboratory tests.

More and more do we realize the breadth of study necessary to gather facts for the explanation of the phenomena that in the light of more superficial knowledge had seemed all-sufficient, and as we draw about us in closer alliance other sciences with which we have come to recognize a more intimate relation, and as with each step we near the true basic principles, it may be said that at last we are come into our own and have attained our majority in the world of science.

I trust that in the dignity of omnipotent majesty, Truth may preside over us, that charity and knowledge hand in hand may guide us in the direction of the greatest usefulness, and that the world may be the better for our having met.

[*For some of the cases and illustrations presented see next page and Plates I-XII.*]

Discussion.

Dr. T. L. Gilmer, Chicago, Ill. I did not hear anything in your remarks in regard to your treatment of these cases.

The Chairman. The paper was not upon any particular line of treatment. It was simply a chairman's address, which was cut off yesterday because our lantern played us false, and it was designed to call attention to the different classes of operations that we could perform better because of our dental training, and also to distinguish them from operations which we might not undertake for the reason that the general surgeon can treat them a great deal better inasmuch as they belong properly to his department. My address was also designed to bring out the point of necessity for better differential diagnosis.

It seems to me that our literature is weaker on the question of diagnosis than anything else; and for this reason I showed these cases—one that had the appearance of being very serious, but which was not really a grave condition, and one that did not at first cause apprehension but which terminated fatally. Yet an examination of the different organs of the body after death showed the same pathologic changes in the remote tissues that were present in the tissues of the mouth, thus indicating the hopelessness of undertaking to treat and cure any such condition locally.

The paper was then passed.

[See preceding page.]

Cases and Illustrations (Plates I–XII).

Some of the Cases and Illustrations, together with Descriptive Matter, presented in connection with the foregoing Address by Dr. G. V. I. Brown as Chairman of Section V.

GROUP I.

Case I. The first case is that of a young married woman who during confinement and for a period of several months before and after was obliged to lie in bed, during which time the pus from some diseased roots and bone in the lower jaw—facilitated by gravity in the unusual recumbent position—had formed between the fascia and muscles of the neck in large quantity, finding exit through a fistulous opening just above the clavicle, and extended upward along the superior maxillary bone to make its way out through fistulæ at the external angle of the eye and the malar bone on the affected side, so that irrigation through the sinus at the clavicle forced pus and fluid out at the corner of the eye or malar bone, and *vice versa.* (See Fig. 1, Pl. 1.)

The general as well as local condition of such a patient might naturally be expected to be bad, and as a matter of fact the toxic influence of such long-continued and profuse pus formation upon the general system was marked by anemia (or dysemia, to use a newer term) with general weakness, yet upon the removal of the exciting cause, and continuing proper treatment, complete recovery followed—a result quite different, as may be noted, from other cases herein described which were outwardly less serious but in which fatal results ensued despite every possible care.

Case II. A man, age forty-five, high-class mechanic, married, large family of healthy children and no history of specific disease. General health good until within a few months of the time real trouble began, when he left work and called his physician, in whose charge he had been during a period of about two weeks until referred to me. Mouth and teeth were coated and very foul, lingual surfaces of the roots of the anterior upper teeth very slightly denuded, as from pyorrhea pockets, and sloughing of gingival margins in that region was noticeable. Anemic appearance was marked. Blood counts taken at different stages of the disease were as shown in the accompanying table.

Blood analysis in Case II.

Name.	Normal.	Condition present.	
Red corpuscles	5,000,000	1,704,640 15,000,000	 Aug. 10th
Hemoglobin	100 per cent.	45 30	per cent. " "
Corpuscle index	1 " "	1.3	" "
White cells	7,000	93,100 105,000	 Aug. 10th
Polymorphonuclear neutrophiles	70 per cent.	8	per cent.
Small lymphocytes	8 " "	26	" "
Large lymphocytes	20 " "	60	" "
Remnants of leucocytes	¼ of 1 " "	6	" "
Megaloblasts	none	1 to each 100 leucocytes	
Normoblasts	none	1 to each 100 leucocytes	

Sloughing extended to center of hard palate and an effort was made to remove the diseased

Group I. FIG. 1.

Young woman showing fistulous opening in the region of the clavicle, of the cheek, and at the angle of the eye.

tissue. The patient was anesthetized and the roof of the mouth was almost entirely removed. In all directions the bone seemed to be dead and of a gray greenish color, but nowhere could any tendency be found to the formation of a sequestrum. The gangrenous condition, such as is also noted in the following case (see Case III), continued until death resulted in about ten days.

Much is often said of the widespread influence and character of oral diseases, but it is not often that such striking examples are found as shown by the microscopic sections of the different organs of this man's body.

In the microscopic examination of tissue removed from mucosa covering the hard palate at border of necrotic area, one-half of the section showed thickening and proliferation of the epithelial covering. Immediately beneath the epithelium were formed marked round cells, and leucocytic infiltration was in evidence, also here and there areas of karyhexis. Adjoining the inflammatory area was the necrotic zone. Here the epithelium was entirely removed, the tissue being represented by broken-down nuclei, leucocytes, and amorphous débris.

Case III. A young man, age about twenty-two; so far as could be learned, of good general health until some two weeks before being referred to me, during which time he

Gr. II. FIG. 2.

Woman with sarcoma of the antrum involving the entire palate.

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had been under the care of his physician. Face on right side badly swollen, temperature 104°, pulse 120. Examination disclosed the fact that inflammation had begun in the gum tissue upon the buccal and distal sides of the lower third molar, from which region there was a dark, ink-like discharge but no appearance of pus. It was necessary to use a mouth-gag in order to open the jaws sufficiently for treatment. Notwithstanding prompt local and general care the inflamed area extended until finally an opening was formed through the cheek, and noma in typical form developed. Black masses of tissue formed so rapidly that five or six dressings with powerful antiseptic agents daily, and moist antiseptic applications almost constantly, failed to check the destructive progress of the condition. Pulse rate and temperature ranged as high as 136 and 105 respectively. Mental faculties remained undisturbed until about the eighth or ninth day, when slight wandering was noticed. About the twelfth day expectoration of black gangrenous masses and red blood showed that the affection had extended to the lungs, and death shortly resulted.

During this period the best of hospital care was given and every effort made to combat the disease locally as well as to support the system generally, but with no apparent benefit, and yet bacteriological examination showed staphylococcus infection, not streptococcus as was expected.

Gr. II. FIG. 3.

Skull with malposed tooth.

GROUP II.

This group relates to benign and malignant growths, and gives us additional food for reflection.

Fig. 2, Pl. II. Woman with a sarcoma. The history of this case exemplifies the disastrous and hopelessly fatal results that follow neglect of an originally benign disease of the maxillary sinus—its final progress, the malignancy of sarcoma as indicated by the series of microscopic sections [not reproduced here] taken from the growth. The case seems to show an originally benign disease of the antrum neglected for years, but during the last few months a progressive increase of malignancy set in that was absolutely beyond surgical control. [Slides shown exhibited an older portion of the growth, with spindle-cell sarcoma; further progress of the disease showing spindle-cell and round-cell, while the newest area of the growth showed the pigmentation of melano-sarcoma.] The hopelessly fatal condition was reached owing to delay that I trust may in the near future come to be considered inexcusable.

Another slide in this group [not reproduced here] was taken from a growth removed from a female patient sixty-three years of age who had always previously enjoyed excellent health; family history good, and grown-up children seem to be healthy. The case presents chronic disease of the maxillary sinus, the result of neglect and imperfect diagnosis, for the physician laughed at the suggestion of a serious disease, and several minor operations were performed before she was referred to me. It had finally resolved itself into carcinoma as seen by the section shown; and although extensive removal of tissue was made, involving to a considerable extent both maxillæ and the vomer, with prescription for X-ray treatment, the prognosis is most unfavorable, the likelihood of recurrence being very great.

Bringing these demonstrations of ill omen directly to bear upon practice, we conclude that no chronic inflammatory condition, however simple and harmless it may appear, should be allowed to continue without treat-

Gr. V. FIG. 4.

Baby with single hare-lip. Nose flattened and drawn to one side.

Gr. V. FIG. 5.

Same baby after operation. Note straightened nose, equality in shape of alæ, and closed mouth, indicating nasal breathing.

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ment; no source of long-continued irritation should be left uncorrected, even though of slight annoyance; every suspicious growth or lesion concerning which the operator is in doubt should be promptly referred to someone whose constant familiarity in practice enables him to decide as to its character.

Fig. 3, Pl. III, comes between the preceding group and the one to follow, and in its two most important aspects refers to each. The tooth shown occupies a position in the skull in which it has been photographed much like one found in the case of a patient of seventy-one years of age who had worn a full upper denture without knowledge of its presence, and who was under operation for a suspicious-looking growth having its beginning in this region; this growth, upon later examination, proved to be malignant, finally causing death.

It is also similarly situated to one found in the jaw of a patient who was a chronic sufferer from excruciating trifacial pain for a period of seven years, and had become almost a mental as well as physical wreck in consequence. With the picture before us we can readily see why almost every known method of treatment which he had tried failed to give relief, but we should also keep in mind the fact that Cryer, Price, and other X-ray investigators have demonstrated that malposed, unerupted teeth are much more common than we formerly supposed; therefore these two classes of very serious affections need constant watchful care to guard against.

GROUP III.

This group embraces a number of patients with characteristic nervous affections all having a noticeable similarity of appearance, yet each one different and some of them diametrically opposite in character.

One slide [not reproduced here] represented a patient in one of the spasms of pain which he suffered at intervals of from one or two minutes for a period of five years. Correction of the occlusion, the removal of a tooth-pulp, and a slight operation upon one of the branches of the superior maxillary branch of the fifth nerve left him free from pain. Observation for some two or more years after

Gr. V. FIG. 6.

Baby with single hare-lip. The characteristic nasal and facial deformities are apparent.

Gr. V. FIG. 7.

Same baby as in Fig. 6, after operation. Nose straight; nasal breathing. Twelve months old—five months later than in preceding picture.

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operation has confirmed the correctness of the diagnosis of these simple etiologic factors.

Another patient suffered attacks at intervals of a few minutes—and at times of seconds—for twenty-five years. Her family history revealed that several near relatives were affected by some neurosis, and she herself was a typical neurotic; but notwithstanding all this, resection of the inferior dental nerve and an operation for relief of a chronic mucous engorgement of the maxillary sinus gave much permanent benefit, and for a short period of time entire relief from pain, with hopeful prospects of complete cure.

Two slides shown [not reproduced here] illustrated a case of unilateral facial paralysis in a man. Operation for a chronic necrotic condition of the lower jaw upon the affected side removed that diseased condition and gave a slight immediate relief to the paralysis, but his death some weeks later indicated that the true cause of his symptoms was central in character, though we have no post-mortem evidence of the nature of the brain lesion.

Surely one need have no stronger evidence than this mute testimony to bring a realization of the value of great care and discrimination in diagnosis, and of the home truth that in our special field, where the all-powerful and wonderful fifth nerve presides, no etiologic factor is so small that it may, with impunity, be overlooked, and results are often out of all proportion to their causes, and even the simplest factor may be vital in its importance.

GROUPS IV–VI.

Among the slides shown belonging to Group IV were pictures of an individual at different periods of her life, the last one shown being at thirty years of age after face, nose, and mouth had been corrected. These photographs have, I believe, been instrumental in accomplishing much good, having been shown and described by Dr. Nelson M. Black, of Mil-

Gr. V. Fig. 8.

Baby with double hare-lip and the usual oral, facial, and nasal distortions.

Gr. V. Fig. 9.

Same baby as in Fig. 8. The parts bound in position after preparatory operation on the vomer and manipulation to bring them into normal position before final operation.

Gr. V. Fig. 10.

Same baby as in Figs. 8 and 9, after preparatory operation and treatment, with parts ready for closure by final operation.

Gr. V. Fig. 11.

Another view of same baby as in Figs. 8, 9, and 10, after treatment. Sides of fissures remain in contact without sutures. Notice improvement of the nose. Child now ready for final operation on the lip.

Gr. V. FIG. 12.

Baby five weeks old, with characteristic deformity of double hare-lip.

Gr. V. FIG. 13.

Same baby as in Fig. 12; front view after operation.

waukee, with whom I co-operated in the treatment, and by myself before a number of medical and dental societies during the past few years; illustrating as they do a case with a striking record of almost total deafness, neurasthenia with mental derangement, a history of a sanitarium with the care of a keeper; followed by improvement in hearing, disappearance of neurotic symptoms, an increase of thirty pounds in weight with restoration to normal health, and finally marriage, which could not have been practicable under former conditions, all by widening of the dental arch and through it of the maxillæ, correction of the occlusion, and treatment of the nose and middle ear, made possible through these simple means.

I do not know who first tried to apply direct pressure to widen the dental arch by separation of the maxillary bones at the median suture. I have done it for more than ten years, as doubtless many others have, but I believe that the first definite work of this character done for the specific cure of nasal, aural, and nervous affections systematically carried to a successful issue was done by Dr. Black and myself, as reported to the National Dental Association and other societies. I make this statement not for myself, but in justice to Dr. Black, as it is only to be expected that as the work assumes its full importance in the eyes of the profession there will be many claimants.

Dr. Bogue builded better than he knew when he began his good fight for the preservation of the first molar. It lies at the very heart of the question, for arrest of development must be pre-natal or post-natal. If the individual be normal it is little less than a crime to deprive him of his birthright by giving opportunity for an artificial interference with developmental processes: and the first molar is the very key to facial and maxillary growth. Erupting as it does at a stage of life so important as to be termed a period of stress, and held accountable by Kiernan and others for epilepsy and like affections in many cases, its importance cannot be questioned. If, on the other hand, through degenerate heredity, malnutrition,

Gr. V. Fig. 16.

Gr. V. Fig. 17.

Fig. 14. Patient twenty-two years of age. The lip was closed in infancy by a famous surgeon whose skill is beyond criticism, yet the failure to adjust the maxillary bones resulted in great nasal and facial deformity. Ala flat and nose almost entirely on one side of face.

Fig. 15. Same view of patient shown in Fig. 14, after lip had been reoperated on, scar tissue removed, and jaw and nose straightened.

Fig. 16. Side view of same patient, to be compared with Fig. 17.

Fig. 17. Side view of same patient. Compared with Fig. 16, shows ala of nose on right side to be of same shape as on the left.

Gr. V. FIG. 18.

Shows deformed facial appearance after intermaxillary bone has been removed to close double hare-lip.

Gr. V. FIG. 19.

Same boy as in Fig. 18. Palate was closed in early infancy; result at seven years of age is seen. Stenosis of left naris, and right naris useless for breathing, although probe passes. Disproportion between upper and lower parts of head, due to arrest of development. Voice shrill, and defective pronunciation.

Gr. V. FIG. 20.

Front view of same boy as in Figs. 18 and 19, after operation.

Gr. V. FIG. 21.

Side view of same boy as in Figs. 18, 19, and 20, after operation and restoration to more natural lines in profile.

Gr. V. Fig. 22.

Young man of twenty-two years of age, showing result of early imperfect operation for double harelip.

Gr. V. Fig. 23.

Front view of same man as in Fig. 22.

or other cause [illegible] which he born into the world with a tendency to insufficient bone development, it is even more incumbent upon us to assist the prematurely [illegible] dental organs to assume a proper position, by aiding the proper adjustment of those bones upon which the natural form of every facial feature depends, because in almost every such individual there is a [illegible] tendency.

All of the remaining pictures, which there is not time to describe in detail, have been treated by operation with the foregoing principles in mind, the chief effort being to restore the deformed parts to their normal relations—for, after all, cleft palate and harelip are only greater deformities of similar irregularities, and the same rules apply. Where forcible crushing of the bones for closure of palates in early infancy has been resorted to, in later life this deformity is often very great. This form of operation was much advocated in the past, like the operation for closure of double harelip by cutting off the protruding intermaxillary, which simplified the immediate operation but resulted in such distressing deformity in later years through arrest of development, as is shown by

Gr. V. Fig. 24.

[illegible]

Gr. VI. Fig. 25.

Shows mouth of a patient with cleft through both hard and soft palates.

Gr. VI. Fig. 26.

Same patient as in Fig. 25, with appliance in place.

Gr. VI. FIG. 27.

Same patient as in Figs. 25 and 26, after reduction by appliance and final operation, with perfect result in both hard and soft palates down to tip of uvula.

many cases here presented—occasioned by destruction of the germs of permanent as well as of temporary incisors, which are far advanced in their development before birth—will also soon be looked upon as little short of malpractice, for the same reason and because those children operated on in early infancy who escaped the dangers of the operation itself are now growing to be living proofs of the truth of these principles.

The system by which the results shown by the illustrations have been secured is one that during the past few years I have made my life-work. The difficulty of successful operation upon palates, with the uncertainty of results, is well known to every surgeon. That much improvement in lip-correction might also be expected is equally evident, also that improvement could only be secured by a systematic study of—

First: Difference of form, character, and age in patients afflicted by these deformities, and recognition of such differences in the manner of treatment.

Second: Etiologic first principles, and the perverted action of natural (chiefly muscular) forces that tend to increase the deformity if neglected.

Third: Application of force that would do no injurious violence to the structures involved and yet be sufficient to bring about a more nearly normal relation of the parts immediately affected with adjacent ones.

Fourth: The conversion of conditions that rendered many cases practically inoperable into such as will make them comparatively simple cases.

Fifth: Improvement in surgical technique whereby greater certainty and rapidity might be secured.

The CHAIRMAN. We shall now call upon JOHN S. MARSHALL, M.D., of San Francisco, president of the Examining and Supervising Board of Dental Surgeons, U. S. Army, to read his paper entitled "The Treatment of Fractures of the Mandible."

The following paper was then read:

The Treatment of Fractures of the Mandible.

By JOHN S. MARSHALL, M.D.,

PRESIDENT EXAMINING AND SUPERVISING BOARD OF DENTAL SURGEONS, U. S. ARMY.

AMONG the most difficult fractures of the bones which the surgeon is called upon to treat are those which involve the mandible, and the difficulties are increased in proportion to the extent of the traumatism, the degree of displacement of the fragment, the amount of bone tissue lost, the age of the patient, the state of health, the habits and environments.

Authorities are generally agreed that fractures of the mandible rarely fail to unite sooner or later—occasionally not till after many months, but finally some form of union either bony or fibrous is established. In an ordinary uncomplicated case of fracture of the mandible union is usually complete in three to four weeks. Where poor health or depraved habits exist—particularly the drink habit—union is often greatly delayed.

Imperfect apposition of the fractured parts is responsible for more cases of delayed union than all other factors combined. This statement holds equally true of fractures of the long bones. It becomes the duty therefore of the oral surgeon to adopt those measures of treatment which will the most surely obtain and secure a correct apposition of the fractured parts.

CLASSIFICATION.

Fractures of the mandible are usually classed under two heads, viz, simple and complicated—the complicated being divided into compound, multiple, and comminuted.

Simple, or uncomplicated, fractures may be passed over with the statement that they seldom present more than a slight displacement, and sometimes none at all, the patient not realizing that the bone is fractured except from the pain experienced from crepitus when the mandible is in use. This class of fracture rarely requires the employment of any special method of treatment other than ligating the teeth upon opposite sides of the fracture, and the application of a four-tailed bandage.

Complicated fractures are legion in number, and frequently tax to the utmost extent the ability of the surgeon to overcome their tendency, after adjustment to a normal position, to slip out of place and assume the original malposition, thus in many cases defeating his efforts to a greater or less extent and producing a malocclusion of the teeth and in some instances a more or less unsightly facial deformity.

Compound fractures which involve

only a single break in the continuity of the bone and laceration of the overlying soft tissues are the least formidable of the complicated fractures, because as a rule there is but little displacement, and a simple method of treatment—such as the adjustment of an external splint, and bandaging, the application of fracture bands, or wiring together the teeth which are located upon the opposite sides of the fracture—is all that is called for. Hemorrhage from the inferior maxillary artery occasionally immediately follows the injury, and there is sometimes paralysis of sensation of that portion of the mandible and external tissues supplied by the inferior dental nerve. Paralysis, however, is never permanent, while infection usually follows the injury even after the most scrupulous attention is given to cleanliness and antiseptic methods.

Multiple fractures involving two or more breaks in the continuity of the bone are usually accompanied with displacement of the fragments and proportionate injury to the soft tissues overlying them. Hemorrhage, paralysis, and infection are the usual complications. The simple methods of treatment just mentioned are of little value in these cases, and if wholly depended upon will prove a grievous disappointment, as many surgeons have found by humiliating experience. Suppuration, necrosis of bone, more or less facial deformity, and malocclusion of the teeth have been the usual sequelæ of such treatment. Multiple fractures are generally the result of severe crushing injuries or of gunshot wounds, and constitute the most difficult class of all the fractures of the mandible to treat without leaving a facial deformity, or a malocclusion of the teeth. I have seen many cases of this character and of multiple fractures which had been discharged from hospitals with ununited fracture or a serious facial deformity and malocclusion of the teeth. In some instances the teeth did not occlude upon the injured side by an eighth of an inch or even more, or the mandible was so shortened upon the injured side that all the teeth were thrown out of their normal occlusion, and mastication made well-nigh an impossibility. Such results are, in my judgment, a blot upon the fair name of surgery, and in the present day ought not to occur, and would not occur if the surgeon would recognize the fact that the oral specialist is much the better qualified by special education and experience to treat such cases.

Essential Conditions in Treatment.

The conditions which are absolutely necessary to the successful treatment of fractures, no matter where located, are: First, accurate adjustment of the fractured portions of the bone. Second, immobility of the parts until union has taken place.

In cases in which the bone is comminuted or a portion carried away, as in gunshot injuries, it will be impossible to bring the fractured parts of the bone into apposition without causing a shortening of that side of the jaw. It therefore becomes necessary to place the remaining fragments of the mandible in their normal position and maintain them in that position by an interdental splint or other mechanical device until the wound has healed, trusting to nature in the one case to unite the comminuted fragments or form new bone in their place, and in the

other that new bone may be formed to take the place of the section lost; or failing in this, that a fibrous band may be formed of sufficient strength to support a bridge splint made after the plan suggested by Dr. Patterson[1] of Kansas City.

Reproduction of new bone to fill a space in the mandible caused by gunshot injury or a surgical operation is very rare. But your essayist had the good fortune to report such a case in the *Dental Cosmos* of October 1903,[2] which will be briefly referred to a little later on.

Adjustment of the fracture. Accurate adjustment of the fractured portions of the bone is by no means always a simple undertaking, particularly in those cases classed as multiple fractures occurring between the symphysis and the angle, for the reason that there is always a considerable amount of displacement of the fragments, caused principally by the power of the digastric, the genio-hyoglossus, and the mylo-hyoid muscles, which act upon the anterior fragment from below, dragging it downward and slightly inward, while the posterior fragment is drawn upward and inward by the action of the masseter, the temporal, and the internal pterygoid. The central fragment in the case of double fracture upon the same side usually overrides the other fragments externally. This overriding is generally due to the central fragment being formed at the expense of the external or buccal plate of both the anterior and posterior fragments, having the form of a blunt wedge with the apex directed toward the mouth.

The greatest displacements occur, however, in cases where the body of the bone is fractured upon both sides, in locations between the second molar and the lateral incisor. In those cases the central or anterior fragment is sometimes displaced downward to the extent of from one-half to three-fourths of an inch, and inward an equal distance toward the tongue, the posterior fragments overriding the central fragment externally. In this class of fracture it is usual to find the central fragment formed at the expense of the internal or lingual plate of both posterior fragments, and having the form of a blunt wedge with the apex pointing outward or toward the lip.

Maintaining immobility of the fracture. These cases cannot be successfully immobilized except by two methods of treatment, namely, (1) interdental splints constructed upon the plans of Hayward[3] of London, who successfully employed it in 1858, and of Kingsley[4] who employed his in 1864, or upon the plan of Gunning[5] who first used this splint in 1861, and of Bean[6] who first employed his in 1864; or (2) by suturing the fragments together with silver or copper wire after the plan first suggested and successfully practiced by Dr. Buck[7] in 1847 and reported to the New York Pathological Society during that year, revised by Professor Hamilton[8] in 1858, and employed by Dr. Kinlock[9] in 1859. The details of constructing these various forms of interdental splints are known to all dental surgeons and therefore need not be described here.

The method of suturing with wire will be described later when detailing the operation in two practical cases treated within a recent period—one for ununited fracture of the ascending ramus, and the other for a compound multiple fracture with considerable displacement of the fragments. The wire suture operation has an advantage over all other methods for treating ununited fracture of long

standing, for the reason that if the suture is properly placed it holds the fragment in perfect apposition and by reason of its presence stimulates the reparative process in the bone. In this class of cases, and also where the fracture in the ascending ramus is of recent date, the suture should be buried and allowed to remain. Such foreign substances left buried in the tissues are entirely harmless and I have never known removal to be necessary.

In operations upon multiple fracture and ununited fracture of the horizontal ramus it is not necessary to attempt to bury the suture, as this would entail the making of an extensive incision in the external tissues, with a consequent unsightly scar. In these cases the operation can be done from within the mouth, and the end of the sutures so placed that they can be readily reached and removed after the process of repair has been completed. That method which will the most surely secure accurate adjustment of the fragments of the bone and maintain their immobility will give the most successful results.

The successful oral surgeon never ties himself down to one method of treatment, for no two cases are exactly alike in character or individual features, and consequently require variation in methods, appliances, or operations, as adapted to the requirements of each individual case. The simplest method that is effective is always the best, and I believe this to be a sound principle by which to govern all operations for the treatment of this class of injuries. It has been my fortune to treat a considerable number of fractures of the bones of the face and I have always found the best results to follow the simplest methods of treatment.

The following cases, which will be briefly detailed, have presented for treatment during my assignment to duty at the U. S. Army General Hospital, Presidio, San Francisco, California, from September 1, 1901, to June 30, 1904. The cases appear in the order in which they presented, without reference to their classification. The patients were either soldiers or civilian attachés of the army.

Cases.

Case I. (C. A. Y.) Male; white; age twenty-one years. Was admitted to hospital October 20, 1901, with simple fracture of the mandible, left side, at the angle, and contusion of the left side of the face. The injury was received on October 19, 1901, by being struck in the face with the fist during a quarrel. Treatment consisted of placing fracture bands upon the first bicuspid teeth, upper and lower, upon both sides of the mouth, and wiring the jaws together with figure-of-8 ligature; in this case and all which follow the patient was placed on liquid diet, the mouth irrigated after each meal with a solution of mercury bichlorid 1:1000, and a solution of hydrozone 1:4 used on rising and before retiring at night. There were no complications during the treatment and the patient was returned to duty on November 26, 1901, with union of fracture perfect and occlusion of the teeth normal.

Case II. (A. M.) Male; white; age twenty-seven years. Was admitted April 14, 1902, with compound fracture of the maxilla, left side, upper left first molar fractured, left side of the face lacerated, line of fracture horizontal through the maxillary sinus. Displacement slight. Injury received the day before by kick of a horse. Treatment consisted of placing the fractured bone in normal posi-

tion and maintaining it in that position by closing the lower teeth upon the upper and holding them together by the application of a four-tailed bandage. Irrigation as in Case I. Case was complicated for a few days by infection and suppuration. Returned to duty June 1st, with slight scar in left cheek. Union of fracture perfect; occlusion normal.

Case III. (J. Q. Q.) Male; white; age twenty-four years. Was admitted to hospital November 2, 1902, with compound fracture of maxilla, right side. External wall of antrum crushed in. First and second bicuspid and first molar loosened. Contusion and laceration of right cheek. Injury received a few hours previously by a kick of a horse. Operation consisted in removing several spiculæ of loose and detached bone; after which the wound was irrigated and packed with borated gauze. No complications were present at any time. Patient returned to duty on December 10, 1902. Made good recovery; teeth became firm; opening into antrum closed. Slight scar on right cheek.

Case IV. (F. N. T.) Male; white; age twenty-six years. Was admitted to hospital November 9, 1902, with compound fracture of the upper alveolar process, involving the four incisor teeth. Displacement slight; upper lip much swollen and contused. Injury received the night before by falling from a moving street-car, while intoxicated. Treatment consisted of placing the fractured alveolar process in its normal position, and supporting it by passing wire ligatures around the incisors and attaching to the canine teeth. No complications developed at any time, and the patient was returned to duty December 20, 1902. Fracture united perfectly, and the incisor teeth are apparently vital.

Case V. (L. K.) Male; white; age twenty-three years. Was admitted to hospital June 27, 1903, with compound multiple fracture of the mandible at the symphysis and between the left lateral incisor and the canine. Central fragment displaced downward. Injury received about May 25, 1903, by being struck with the fist upon the left side of the mandible near the chin. Fractured bone placed in normal position and maintained by external splint and bandage. Case complicated with slight suppuration. This patient was not on sick report, and was *en route* to the Philippine Islands, with his regiment. Nothing more was done for him.

Case VI. (R. C.) Male; white; age twenty-four years. Was admitted to hospital, from the Philippine Islands, October 25, 1903; ununited fracture of ascending ramus, right side, directly above the angle; line of fracture horizontal to ascending ramus. Injury received about August 9, 1903, by being struck with the fist. Case complicated with suppuration and necrosis. Two pieces of necrosed bone removed. Treatment consisted of applying fracture bands and wiring jaws together. Returned to duty December 16, 1903. Union perfect; occlusion normal.

Case VII. (H. H. D.) Male; white; age twenty-four years. Admitted to hospital February 4, 1904, with compound fracture of the mandible at the symphysis. Displacement slight; motion at fracture considerable. Injury received February 1, 1904, by being struck with the fist. Face not bruised. Operation consisted of applying fracture bands to the lower canine teeth, and securing the fracture in position by figure-of-8 wire ligature passed across the symphysis from one canine to another. Case was complicated with suppuration. Returned to

duty April 5, 1904. Union of fracture perfect; occlusion normal.

Case VIII. (H. T.) Male; white; age thirty-two years. Admitted to hospital March 27, 1904, with compound fracture of the mandible, left side, through the region of the second bicuspid. Displacement considerable. Injury received the day before by being struck with the fist in a pugilistic encounter. This patient was a military prisoner. Operation consisted of applying fracture bands to the upper first bicuspid and upper first molar upon the injured side and to the right first bicuspid, and wiring the jaws together with figure-of-8 ligature. Patient was transferred to Alcatraz Prison to serve his sentence. The case was reported by the post surgeon of Alcatraz Prison, on June 1, 1904, as having made a good recovery.

Case IX. (G. E. A.) Male; colored; age twenty-five years. Admitted June 24, 1904, with compound fracture of the mandible, right side, through the alveolus of the third molar; first and second molars of right side decayed to the gums. Displacement of the fracture slight. Injury received by being struck in the face with a brass knuckle during a row in camp three days before admission to hospital. Operation consisted in applying fracture bands to the upper and lower first bicuspids on both sides and wiring the jaw together in the usual manner. Right side of face contused and swollen. Wound at fracture suppurating when admitted to hospital. July 10th, large abscess developed at angle of right side of mandible; opened and drained. August 20th, fracture united, and occlusion of the teeth normal, but there still remains a superficial abscess in the right cheek, which is rapidly healing. Patient will be returned to duty in a few days.

Case X. (D. M.) Male; white; age twenty-eight years. Admitted to hospital from Philippine Islands, with ununited fracture of the ascending ramus, right side, situated one-half inch above the angle; followed by a fibrous adhesion and false joint. Ramus was displaced forward. Injury had been received September 7, 1903, by his being struck in the face with the fist, and had been followed by suppuration and necrosis. Was treated for several months at First Reserve Hospital, Manila, P. I. Returned to the United States to be discharged by reason of termination of term of enlistment. Operation consisted in making an incision along the lower border of the mandible from opposite the first molar, right side, to a point just beneath the pinna of the ear, dissecting the tissues from the bone, removing the fibrous band uniting the fractured surfaces of the bone, freshening these surfaces with the surgical bur, raising the periosteum for the distance of half an inch from each end of the bone, drilling two holes in each fragment opposite each other, passing the wires by crossing them on the lingual side of the mandible. This brought the fragments well into position, and gave a normal occlusion of the teeth. The wounds in the external tissues were then closed with catgut sutures, the periosteum being first carefully brought together and united with fine catgut sutures. After this the muscular tissues were united in the same way with interrupted sutures, and the skin closed with a continuous catgut suture. The superficial suture in the skin was removed on the fifth day. Up to this time the wound bid fair to unite completely by first intention. On the seventh day slight swelling developed near the most dependent part of the wound. On the eighth day

slight fluctuation was discovered, and the wound was opened and drained. On the fourteenth day suppuration had ceased. On the twentieth day after operation the wound was perfectly healed.

August 20, 1904: The fracture has united and the patient is able to masticate ordinary cooked foods. The occlusion of the teeth is normal and the function of the muscles of mastication has been so well restored that the patient can grit his teeth with such force that the sound can be plainly heard for a distance of ten feet or more. This patient is still in hospital suffering from a medical disease.

Case XI. (E. M. Mc.) Male; white; age twenty-six years. Was admitted to hospital June 24, 1904, with compound fracture of the mandible, right side, between the second and third molars and upon the left side between the lateral incisor and the canine. Central fragment considerably displaced downward. Injury was received June 23, 1904, by being struck on the face with the fist in an altercation. Operation consisted of wiring both fractures from within the mouth: on the right side by drilling a hole in the jaw well down toward the middle third of the roots of the teeth between the first and second molars, passing the wire through the hole, and then behind the third molar, and twisting the ends of the wires together on the buccal surface of the mandible at the hole drilled for the passage of the wire. The left side was treated by drilling two holes in the central fragment between the central and lateral incisors, about one-half inch apart, and two holes at opposite points in the posterior fragment between the canine and the first bicuspid. The wire was so passed as to cross upon the lingual surface of the mandible, and secured by twisting the ends together. Bandages were also applied. Suppuration occurred from infection at time of injury, but subsided at the end of a week. August 3d the patient was allowed to absent himself from the hospital on pass for three hours, and returned very much intoxicated. August 16th the wire in the right side of the jaw became displaced and was removed. August 21st the wire was removed from the left side of the mandible. Both fractures had firmly united, and the occlusion of the teeth is normal. August 22d the patient was returned to duty.

GUNSHOT FRACTURE.

Case XII. (C. D.) Male; aged seventeen years; a Filipino boy acting as servant to an officer. Was admitted to the hospital May 31, 1903, immediately after the injury, with a gunshot compound comminuted fracture of the mandible, caused by the accidental discharge of a 38-caliber service revolver in the hands of another Filipino boy. The wounded boy was sitting upon the floor of the tent, the other was standing near the opening of the tent and upon the left side of the injured boy, when the weapon was discharged. An examination of the case revealed the following conditions: The missile entered the left side of the face, about one inch posterior to the angle of the mouth, and about one-half inch above the lower border of the mandible. The direction taken by the bullet was slightly downward and backward, passing through the left side, comminuting the bone, the first and second bicuspid and the first molar, passing through the tongue and right submaxillary gland, colliding with the lower border of the mandible upon the right side, at the angle, cutting out

a semilunar section, but not causing a complete fracture at this point, and emerging upon the right side of the neck just beneath the angle of the mandible. Hemorrhage was quite severe, but was controlled by packing the wound with gauze and applying cracked ice to the mouth. Dressings were applied and secured by an occipito-mental bandage.

The swelling of the tongue and external tissues of the face was so great that no effort was made until June 7th to place the fragments of the jaw in normal relation. Upon a further examination of the case at this time it was found that a considerable section of bone had been comminuted and carried away, that the posterior fragment was displaced upward and inward by the action of the temporal, masseter, and internal pterygoid muscles, while the anterior fragment was displaced downward and inward by the action of the platysma myoides, digastric, genio-hyoglossus and genio-hyoid muscles. Swelling and suppuration were too great to permit of using any interdental support at this time.

On June 21st the swelling had subsided sufficiently to permit a plaster-of-Paris impression to be taken of the fractured mandible from which to construct a Gunning or Hayward vulcanite interdental splint. On the 25th the splint was adjusted, and maintained in position by binding the jaws together with a four-tailed bandage. The splint was so constructed as to cover all the lower teeth, but only the upper bicuspids and molars. An opening for the purpose of feeding was made in the left side of the splint, where the lower teeth had been carried away. Considerable difficulty was experienced in adjusting the fractured parts of the bones to their normal position on account of the adhesions which had formed, but these were broken up under an anesthetic.

On the two following nights the patient disarranged the bandages, allowing the splint to slip from the mouth. This difficulty was overcome by having all the hair shaved from his head, and after the splint was again adjusted the jaws were firmly bound together by strips of surgeon's adhesive plaster about three-fourths of an inch wide and long enough to pass under the chin and over the crown of the head. The strips were applied with as much tension as possible. Three strips were used, and applied just in front of the ears, the ends lapping from two to three inches upon the crown of the head. By this method the mandible was held securely in its correct position, and by no effort of the muscles was it possible for the patient to again dislodge the splints.

During the progress of the case several abscesses formed under the right side of the mandible and in the cervical glands, from which numerous small pieces of bone, tooth-structure and fragments of the bullet were discharged. An abscess also formed upon the left side of the mandible. The patient was confined to a strictly liquid diet through the entire period of his treatment, but gained eleven pounds in weight during this time.

Thirty days after the final adjustment of the splint and fifty-seven days after the injury, the splint was removed for the purpose of noting the progress in the process of repair, and it was found that the fractured bone was fairly well united, and the occlusion of the remaining teeth perfect. The muscles of mastication were slightly stiff from disuse. The splint was again adjusted and main-

tained in position by the aid of the adhesive strips.

Eleven days afterward the splint was again removed and the fracture found to be so firmly united that its further use was unnecessary.

On August 15th—or seventy-six days after the injury—the boy was discharged cured, and in as good condition as before the accident, save for the loss of three teeth and slight scars upon the right and left sides of the face.

SPECIAL FEATURES OF THE CASE.

There are several interesting features in the history of this case

(1) The bullet in its course through the face comminuted the left side of the mandible and the first and second bicuspids and the first molar, carrying the fragments before it into the tongue and the right side of the neck, where they afterward produced abscesses.

(2) The bullet was one of the soft-nosed variety, and in its passage through the bone was more or less deformed and split up, as was evidenced by the fact that seven pieces were afterward discharged from the wounds and the abscesses which formed in the mandible and neck in the later history of the case.

(3) Although the bullet came in contact with the mandible at the right side, cutting out a semilunar notch from the lower border and body, it did not produce a complete fracture in this region. This, I am inclined to think, was due to the short range and high velocity of the missile as it passed through the bone. Had the range been longer, and the velocity consequently diminished, the damage to the bone would have been in all probability much greater.

(4) The loss of bone tissue from the left side of the bone was considerable, and I feared the gap was too great to be filled in with new bone, and that an ununited fracture or a false joint would be the result. With this fear in view, the construction of the Gunning or Hayward splint was decided upon, as it would best hold the ends of the fractured jaws in their proper relations and secure absolute immobility. The application of the four-tailed bandage is the usual means employed to maintain the proper occlusion of the teeth within the splint, but in this case it proved a signal failure. I therefore adopted the method of shaving the head and binding the jaws together with the strips of adhesive plaster. This prevented the patient from moving the jaws in the slightest degree and secured the immobility of the fracture, which was in this case so desirable. This method of shaving the head and binding the jaws together is not new with me, as I have employed it in several cases in civil practice before I entered the service.

(5) The bullet in its passage through the floor of the mouth passed through the right submaxillary gland, and it seemed at one time in the history of the case as if it would be difficult to prevent the establishment of a salivary fistula beneath the jaw. During the healing of the wound the patient was cautioned to lie upon the left side when in bed, that gravity might carry the secretion of the gland into the oral cavity through the sinus which still remained open into the mouth beneath the tongue. Every effort was of course made to keep the oral opening of this sinus patulous, so as to favor the discharge of the salivary secretions into the mouth; while the external opening was stimulated with silver nitrate to promote rapid granulation and healing, with the result that a salivary fistula was prevented.

(6) Although the splint was worn continuously for forty-one days—thirty days without removal, and again eleven days without removal—the only effect upon the temporo-maxillary articulation from this long immobility was a slight stiffness of the muscles and ligaments, which entirely passed away after a few days of use.

(7) Reproduction of so large a section of bone following such an injury of the mandible is by far the most remarkable feature in the case. Reproductions of extensive portions of bone in the mandible following necrosis have been reported from time to time, but I do not remember to have read of a case of such extensive loss of tissues from a gunshot injury or a surgical operation in which the bone was reproduced and the mandible restored to its normal condition—which goes to show that nature, under the favorable conditions of youth, health, and a little intelligent assistance upon the part of the surgeon, will sometimes produce results that seem to our limited understanding of her resources next to marvelous.

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Discussion.

Dr. D. F. Keefe, Providence, R. I. In my fifteen years' experience as attending surgeon to the Rhode Island Hospital there is one circumstance that has struck me very forcibly, and that is how few cases have to be treated surgically—that is, by wiring of the fragments. Unless there is considerable displacement, or in a case that occurs in a child too young to understand directions, it seems to me to be entirely unnecessary to resort to this method, which is objectionable chiefly on account of the resulting disfigurement. Then, too, in a majority of the cases that have come under my observation perfect occlusion has been absent.

With the interdental vulcanite or aluminum splints we are assured of good occlusion and generally symmetry of the face. An advantage also of the aluminum splint is its easy adaptation, and the freedom that the patient enjoys in the mastication of food. It is my custom to use the vulcanite splint in those cases where the displacement is extensive; but with either appliance I am assured of immediate union and a good result.

I cannot impress too strongly the necessity of thorough cleanliness of the oral cavity while a splint is in position. Abscessed conditions present themselves which many times are due to pressure at the point of fracture. For this reason I discard the external splints, which I think should never be used in any case.

I have two casts here which I will be very glad to pass around for your inspection. The first is a fracture between the canine and lateral on the left side. This injury happened to a boy who fell down an elevator shaft, the only injury which he sustained being a fracture of

the mandible. The impressions were taken on the day of the accident, the aluminum splint was prepared and put in place, and he went back to work three days after. There was some displacement, but not very much, and perfect occlusion was secured when the case was finished.

The other cast represents the case of a patient who had been kicked by a horse. The maxilla was fractured on the left side, in the region of the bicuspid and molar, the process being broken so that it included the antrum. I used the rubber vulcanite splint in this case. This vulcanite splint, you will notice, does not cover all the teeth. I believe it is a much more simple matter and a good deal better for the patient to have a small splint; you can keep the mouth in a much more cleanly condition. An interdental splint of rubber that is only an inch long, I have found does good service.

Then, regarding the bandaging of fractures: I personally feel that the four-tailed, of which the essayist speaks, and also the Barton bandage, besides causing pressure are very difficult to keep in position, no matter how skilfully and carefully applied. The patient's restlessness while sleeping will loosen them.

I have devised a head-gear made of webbing one inch wide, in skull-cap fashion, with two buckles, attached to which is a chin-piece, and while I never knew of plaster strips being used until now told by Dr. Marshall, I assure you this will do the work just as effectively.

As to fracture bands, I have never been able to make a success of them, for if placed too near the fracture (and they must be to get good apposition) they invariably loosen the teeth, and in such a case as No. VIII described by the essayist, with bands on the first bicuspid and first molar in a fracture in the second bicuspid region, and presenting considerable displacement, I should expect a very poor result, and only wish Dr. Marshall could tell us personally the outcome as to occlusion, and if any teeth were lost, as the post surgeon's report of a "good recovery" is very indefinite.

Dr. F. A. Greene, Geneva, N. Y. My remarks will take the form as in a symposium rather than a formal discussion of Dr. Marshall's paper, as it would not be practicable to discuss a paper thoroughly from simply hearing it read. I presume that I am in the position of a great many other dentists—I do not have many opportunities to treat fractures. But I have had a few, and fortunately for me they have been comparatively simple cases, namely, those cases that most often occur in the anterior portion of the mandible, between the first molar and the canine. An appliance which I have devised, and which is here shown, has been used in two cases, and with very satisfactory results indeed.

To operate the appliance, I first take an impression of the upper and lower jaws, and procure casts with the mandible in the position that it was left in after the fracture. I then cut the cast apart at the point of fracture, and adjust the fragments to restore the articulation. I then make an interdental splint of rubber, *A* (Figs. 1 and 2), allowing the teeth to occlude as closely as possible, with a place for the lower teeth to fit into, and a slight indentation for the upper teeth. The purpose of this is, that it does not necessitate fastening the lower jaw to the upper. With this appliance the patient can move the mandible. This comprises the external dental splint in combination with the interdental, and

the external splint is always ready. It might be a good plan to have about three external splints of different widths for different cases.

The external splint is made of hard brass, nickel-plated, with a cloth chin-piece *J* (Fig. 2), and connected to the interdental splint at *B* (Fig. 2) by the extensions upon the forked attachment *c, c* (Fig. 1). It will be readily seen

FIG. 1.

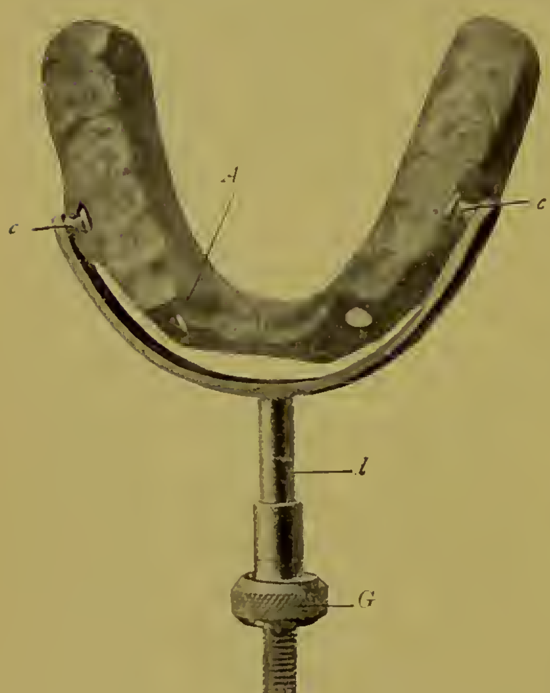
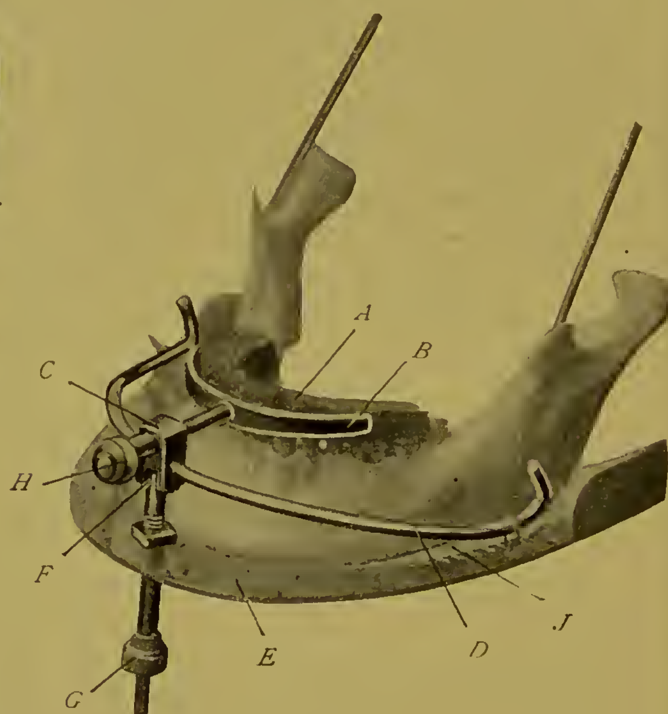


FIG. 2.



—from the extensions *c, c* fitting loosely in the sockets of the interdental splint, and also the projecting arm *d* (Fig. 1) fitting loosely at *C* (Fig. 2)—that when the side arms *D* (Fig. 2) are drawn down and tied to the base-piece *E* (Fig. 2) the pressure must be equal upon all parts of the jaw. There is a hinge joint at *F* (Fig. 2) to allow the side arms and base piece to be drawn together.

The perpendicular adjustment (to fit different cases) is made by the thumb-screw *G* (Fig. 2), and the horizontal adjustment is made by the thumb-screw *H* (Fig. 2). When the case is ready to adjust, I take a little cloth bag (a little larger and of the shape of the cloth chin-piece), which I fill with very slow-setting plaster of Paris, and when flattened out to be about one-eighth of an inch thick, I place this upon the cloth chin-piece, with a thin piece of rubber dam upon it and a thin sheet of cotton upon the rubber. (The rubber dam is to prevent the moisture from the plaster wetting the cotton.) I then adjust the interdental splint in place, attach the external splint, and draw the side arms down tight to the base-piece, and hold carefully in place until the plaster has set. Plaster may be made to set slowly by adding a little flour to it.

Dr. T. L. GILMER, Chicago, Ill. Very few of the splints may be used with benefit, but the majority of splints used in the

treatment of the mandible should be done away with. I would discard every splint for the treatment of a fracture of the mandible except the Heath splint. The one Dr. Keefe has described is the Heath splint with the addition of the external appliance.

Dr. Marshall speaks of wiring through the bone. This is necessary in some cases; but I think we should wire through the bone as infrequently as possible, especially in simple fractures, because of the additional danger incurred by the exposure of the tissues to infection.

In cases of fracture of the ascending ramus, or at any point posterior to the third or second molar, if most of the teeth or a sufficient number are in the mandible, the best results are obtained by wiring the upper teeth to the lower. This may be done with Angle's bands, it is true; but it is not so conveniently done, I think, as by wiring the upper teeth to the lower teeth. I believe that this is a better method of treating fractures in the angle or ascending ramus than by drilling through the bone, unless there are complications.

I discard the use of bandages because they may interfere with the circulation, and retard recovery.

In some cases the teeth are very closely approximated, and it is very difficult to get the Angle bands in place, while at the gingiva we can always carry through the small, annealed German silver wire, which is very soft. If in uniting the wires of the lower teeth to those of the upper we do not connect the teeth directly occluding, but, for instance, unite the upper first bicuspid to the lower second bicuspid, we do not have the direct pull to loosen the tooth, which Dr. Marshall speaks of. I have not seen in the twenty odd years of my practice in wiring teeth in this manner a single tooth loosened by it. If I were to wire only one tooth on each side, and nearest to the fracture, attaching the one above directly to the one below, there might be tension sufficient to loosen those teeth; but we do not wire them in that way.

Dr. S. E. Wallace, La Belle, Mo. I believe that Dr. Gilmer has been truly successful in this method of treatment of fractures. I know of one of the doctor's early cases, treated in 1887—a patient aged fifty-eight years, and at that age we always find the alveolar process is slow in healing and reuniting.

The case was a compound comminuted fracture of the mandible. There was a break on the left side on a line with the first molar; on the right side there was a fracture at the angle. The bone from this point extending up to and including a large portion of the lower half of the ramus, was broken into a number of fragments. The soft parts were lacerated only on the left side. All the teeth on the right side posterior to the fracture were missing. The posterior fragment of the compound fracture was elevated by the action of the masseter and temporal muscles. The anterior fragment, containing all the teeth of this jaw, was drawn toward the left side and greatly depressed, giving the patient an aspect anything but agreeable. The posterior fragment of the left side, which included the greater portion of the ramus and a part of the angle, was but slightly displaced. The treatment was as follows:

On the right side the gum was dissected from the bone on both buccal and lingual surfaces for about an inch anteriorly and posteriorly to the fracture. In each fragment a hole was drilled of suitable size to just admit a No. 16

standard gage platinum wire, which was bent in the shape of a staple. Silver wire is used because it is less irritating and is supposed to be in a measure antiseptic. The fragment having been put in place the two arms of the staple were inserted into the holes from the lingual surface. The arms were brought together on the buccal side and tightly twisted, drawing the parts into close apposition. Next a short steel wire (No. 27) was placed around the neck of each lower tooth between the second bicuspid on the right and the second molar on the left side and the corresponding teeth of the maxilla. The two ends of each individual wire were brought together and twisted, fastening the wire securely around the neck of each tooth. This being done, the teeth of the lower jaw were exactly articulated with those of the upper, and the wires of the lower teeth secured to those of the upper by bringing them together and twisting, thus firmly lashing the lower to the upper jaw. To prevent a lateral motion the wire of the upper left central was secured to the wire of the lower right central, and that of the upper right central to the lower left; this crossing being continued throughout held the jaws immovable. The smaller fragments of the right side were pressed into place as nearly as possible. All outside appliances were dispensed with, the parts being held in place with sufficient firmness by the wires, therefore there was nothing to obstruct the circulation or interfere with the nutrition of the parts.

The patient was advised to thoroughly cleanse the teeth each day, as far as they could be reached, by means of a toothpick and a stiff brush. An antiseptic wash was ordered for frequent use. He was fed on liquid food by means of a long-nozzled bulb syringe known to physicians as a powder blower. The bulb of this syringe was filled with nutrient fluid and its contents discharged into his mouth through the aperture made by the loss of the teeth near the compound fracture. The external wound speedily healed and all seemed to go well until about the third week, when an abscess, probably caused by a spicula of bone unobserved when the fracture was reduced, formed just below the compound break.

A free opening was made into the abscess in such a manner as to establish a thorough drainage. The pus cavity was syringed with hydrogen dioxid and a rubber drainage tube sufficiently long to reach the bone was inserted. Every day, as long as the formation of pus continued, hydrogen dioxid followed by a solution of carbolic acid was forced through the tube. The drainage tube was held in place by three silk ligatures stitched in the lower end, the ligatures being secured to the face by adhesive strips. The fracture of the angle united in about four weeks, while the one with the external complications required two weeks longer.

At this time, the sixth week, the wires were removed, the patient being advised not to use the mandible for strong mastication for some time. The contour of the face is entirely restored, the articulation is good and there is but little left to indicate the miserable condition the patient presented when he first came under the care of Dr. Gilmer. I have seen this man many times since and the remaining teeth were in good order and none the worse off except that they were somewhat abraded, indicating the invaluable service they have rendered, all being firm in their sockets. The case was a severe test of Dr. Gilmer's method

of wiring, and it has proved a perfect success in every respect. I heartily recommend the use of the wire ligature in the treatment of fracture of the mandible.

This case was in the hands of a reputable medical practitioner for four weeks before Dr. Gilmer took charge of it.

Dr. W. J. Roe, Philadelphia, Pa. The first point I wish to touch upon, somewhat at variance with the statement Dr. Marshall made here this afternoon, is that complete union, in many cases, occurs in three to four weeks. I have yet to see a case of union at the end of five weeks in which I have not been able to spring to an appreeiable degree the fragments of the fractured parts. I will go farther: I have yet to see a case at the end of six weeks in whieh I could not demonstrate an appreciable degree of springing by moderately gentle manipulation. Therefore I teach in practice retention of immobilization for a period of five, and in a majority of cases six weeks, in all cases treated by whatever means.

I am opposed—and I am glad that Dr. Keefe has expressed himself in accordance with my own views—to the operation of wiring in, I may say, all cases. I think that it can be avoided to the distinct advantage of the patient. As already said, it opens an additional avenue of infection if the wiring is done within the oral cavity; if done externally we are better able to take care of that feature.

I contend, and teach, that there is no fracture of any portion of the mandible whieh cannot be suceessfully treated by some form of dental or interdental splint. That seems, probably, on the face of it to be a sweeping assertion, but I am ready to substantiate it and maintain the point. Even in cases of delayed union or ununited fraetures—and there is a very dangerous point—Dr. Marshall referred to a case today as one of ununited fraeture of six months' duration between the injury and the time of operation. The case as referred to does not justify being so classed, unless he qualifies it by substantial evidence. I have seen cases at the end of nine months in which there was only fibrous union, or in which there was considerable mobility; I have seen those cases a year or a year and a half later in whieh the union had occurred. Therefore it is very important, when we seek to classify eases as ununited fraetures, to know whether a case is yet past hope at that period of its condition. and the possibility of union occurring with immobilization with a proper method of treatment.

Reference is made to the use of adhesive strips as a most radical method. I have in three cases used something more radical, probably. These three cases were not in the hospital, and when out from under my care would habitually and inevitably become intoxicated, and consequently all the attachments were displaced and the splints out of the mouth. After being annoyed to a considerable degree by the actions of these patients, I had the hair cut closely to the head and then I applied plaster of Paris, covering with a tin cap earrying side pieces firmly attached, and they could then do what they liked, and the splint and bandage remained in position.

I have digressed from what I wanted to say in reference to cases of ununited fractures, in which it is necessary to operate to remove the intervening fibrous tissue, which will inevitably prevent ossification. Where it is necessary to operate, as it is in the case referred to. to remove the fibrous tissue that intervenes between the ends of the bone and to

freshen the ends of the bone, I contend that the best results will be aided by the introduction and wearing of some form of splint as a retaining appliance, and not by the wiring of these approximal ends.

It is not necessary for me to enumerate or detail the points which are involved in the best results, but I can say that such a result is only obtainable by the adoption of some form of interdental splint subsequent to the excision of the fibrous tissue and the intervention of the bone.

It is surprising and almost incredible to note the results that we can obtain where there is a wide separation and considerable loss of bone structure, in this matter of regenerative re-formation of bony tissue. In a case where the chin or mandible was denuded on the left side I was obliged to take out sections of the bone, stripping up the periosteum for some distance on each side and with an instrument forcing it apart until it was separated a distance of three-quarters of an inch, and holding it in that position by the interdental splint. In the time it usually takes to treat the ordinary fracture the filling up by bony union of that intervening space was complete.

Dr. J. D. PATTERSON, Kansas City, Mo. I have a good deal of this kind of work, being fortunate or unfortunate enough to be dental surgeon to a railroad in our section of the country—and it is upon railroads and in railroad accidents that in these days most of the fractured jaws occur.

It is my experience in the fractures which come under our observation, that each case demands a somewhat different treatment from the case which preceded it. I am heartily in accord with Dr. Roe when he says there is no form of fracture that cannot be better treated with an interdental splint than by any of the other methods. And when I make that statement and confirm this expression of Dr. Roe, I do so because I have tried other methods and have not been successful. I have had a variety of cases, and I have never yet had one that was not better treated by some form of interdental splint than with the methods of wiring that have been spoken of.

I have, as an emergency outfit when I am called by the railroad, a splint that was suggested in war times, and improved upon by Dr. Kingsley. It is a large impression cup for the lower jaw, is made of an alloy of tin, and contains slots for arms. I always pack the appliance into my grip, because we can make with it a splint in a few minutes, lining the cup with gutta-percha; it is very useful in an emergency case when we cannot get the patients to our office. sometimes having to go to a little railroad town, or perhaps a country farm-house. I always equip myself with this appliance, and among other things always take along what I call a "halter"; it is made of heavy leather, with an attachment to fit the chin, in which is placed cotton or cottonoid. Sometimes I use that appliance while I make the splint, and at times it is useful to put on while the patient is being taken to the hospital.

When we use the interdental splint it must be very thin, allowing the teeth to come close, in order that the healing there may be the best. We cannot allow much space, so we must make our splint of metal. Usually I make it of silver, and strengthen it by flowing solder over it at different points.

I want to speak of my experience with regard to fracture bands—the most useless things of all the magnificent things

that Dr. Angle has put before the profession. He deserves and I give him all credit for what he has done in many directions, but the Angle fracture bands are, in my opinion, of no possible use. I have never had one case where they could possibly be applied, and have had two cases where other dentists applied them and did not succeed in reducing the fracture. One of these cases did not come to me for nearly two months after the Angle fracture bands were put in, and I am ready to tell Dr. Angle that the fracture bands are absolute failures. As long as we can so easily and rapidly construct some form of splint which allows the patient so much comfort, and permits him to eat solid food after a short time, perhaps even the next day—and this neither the Angle band nor wiring ever allows—I see no use for those fracture bands or methods of that description. In regard to wiring, I have wired the two ends of the bone together, but with little satisfaction.

I challenge anyone to bring me a case of fracture in which I could not apply some form of interdental splint. A case was brought to me some three years ago—an edentulous mouth—and there you are up against it, at least you suppose you are. The dentist and the physician to whom the patient first had gone put a wad of cotton in the mouth, held in place by some gummy substance, and wrapped his jaws together. You seldom find edentulous persons now who have not some form of artificial denture. When the patient was presented, I asked, "Where are the teeth you were wearing before your jaws were broken?" "At home." "Why didn't you bring them, and use them for a splint?" "I never thought of it." So they were brought to me, and I cut out where it was necessary to accommodate the swelling of the tissues, and in twenty-four hours I had the most beautiful splint you ever saw. So, when we have those edentulous cases, we generally have a partial or full plate that solves the difficulty of arranging the jaws or making the splint.

Many cases can be wired with good occlusion resulting; but the use of a splint is easier, more comfortable for the patient, and, in my experience, is absolutely effectual.

If a great amount of the bone must be removed on account of non-union, it is surprising how much of that bone will be regenerated. Dr. Marshall will remember a case of gunshot wound at Kansas City, which I treated for a soldier.

Dr. MARSHALL. I refer to it in my paper.

Dr. PATTERSON. We did not cut into it to see how much of the bone was gone in that case, but I judge it was more than three-quarters of an inch, and one of the bones at the broken end was a mere spicula, while the other was a good blunt end. I put on a bridge splint; within six months from the time I put that splint on the bone had entirely reformed. This I know, because I had to take the bridge off and make another, and I found the fracture as solid as a rock and more than three-quarters of an inch of good bone had re-formed with absolutely no give to it at all.

Dr. ARTHUR D. BLACK, Chicago, Ill. I believe that fully 99 out of 100 cases of ordinary fractures can be treated with the best possible results by the method of wiring the lower to the upper teeth. I also believe that the use of the interdental splint in treating fractures at this day is not giving the patient the best service. When I say interdental splint,

I mean a splint that includes the occlusal surfaces of both the upper and lower teeth and requires a bandage to hold it in place. If you apply the term interdental splint to a splint which is applied to the lower teeth only, with possibly a masticating surface for the upper teeth, it is a very different matter. The interdental splint, as generally understood in past years, if I am not mistaken, was a splint modified from the old form of Gunning splint, in which there was a space for both upper and lower teeth, and this splint was held in place by bandages.

In fully nine out of ten eases of ordinary fractures without external wounds, we are not justified in using anything external on the face or head, and a man who would use an applianee of this kind [indicating mechanical device] in a case of this character, is not rendering his patient the best serviee. He may get quite as good results, but it is unneeessary to use an appliance which makes it unpleasant, and in some eases impossible, for the patient to go out upon the street and get the proper amount of exercise. I believe that in a majority of cases of fracture the patients should be on the street within two or three days, or at least within a week after the case has been treated, for by means of judieious exercise a quicker recovery will be made.

The question has arisen between Dr. Angle and Dr. Gilmer as to whether Dr. Gilmer or someone else was the first to use the method of wiring the lower to the upper teeth. I wish to mention the fact that such a case was reported by Dr. Gilmer in the *Archives of Dentistry* for 1887 (page 388), and a careful seareh through the literature on fractures does not reveal any case reported previously.

Wiring is used by Dr. Gilmer very largely in his practice and at our school. I believe the reason that many men fail in the method is because they do not wire a sufficient number of teeth. If you wire the teeth on both sides of the mouth, no matter where the fracture occurs, there is practically never any difficulty in maintaining the occlusion, and the matter of cleanliness—a very important and essential element—will be best subserved. It permits the thorough brushing of the teeth, and if there is an opening anywhere, it is possible to flush the inside of the mouth and cleanse the lingual surfaces of the teeth. There is in addition the advantage of being able to see the relation of the lower to the upper teeth at all times.

Dr. PATTERSON. In quite a number of fractures where the teeth are all in the mouth, circumstances might indicate wiring; but the teeth posterior to the break, or the two teeth anterior to the break are very often loosened; with the splint we ean keep them in, placing them back firmly again. What do you do in wiring? Do you wire the ends of the bone then?

Dr. BLACK. No. If the fraeture was anywhere along the side of the mandible back of the bicuspids, and the teeth back of the fracture were loose, it is not necessary to wire those teeth, as the masseter muscle will hold them in position.

Dr. PATTERSON. There won't be any other teeth that are firm on that side. Suppose all the teeth are gone?

Dr. BLACK. If all the teeth are gone, or not enough remain to hold the upper to the lower jaw, you cannot wire the teeth together. We must suppose that there are enough teeth in the mouth to wire the upper to the lower teeth, and I believe in the majority of cases there are enough.

I recall a case which might more fully answer the question—the case of a patient with a fracture between the lower second and third molars. The entire mesial surface of the root of the third molar was exposed, so there was no hope of saving that tooth, as the case had been standing a week or ten days and pus was present, though the tooth could not be extracted at that time, as it was too firm. The teeth were wired, and in the course of two or three weeks that tooth beeame loose through alveolar neerosis and came out, and the full mesio-distal width of the tooth was lost from the body of the bone from the same cause. The wiring was done without paying any attention to the posterior fragment; the masseter muscle drew the fragment forward and upward in apposition to the anterior fragments, and union was obtained in that way. The oeclusion of the teeth was correct, but there was a deformity in the lower border of the bone. If the fracture were farther forward in the mouth than the bicuspid, and if the teeth were loose on either side of the fracture, there would generally be enough teeth left to wire without paying any attention to the loose teeth close to the breaks.

I saw a case of a clothing salesman with a fracture in the canine region. In his ease the molar teeth were wired without putting any wires on the incisors, and he learned to talk sufficiently plain in three or four days to be able to retain his position. Here are some models of cases in practice—the fractures in each case being marked with a lead pencil—and the wires are just as they were on the teeth. These casts were taken at the time the cases were dismissed and you can judge of the occlusion.

Failures in wiring teeth are caused, I believe, in many cases, by the use of the wrong kind of wire. If brass wire, silver wire, or any wire that will stretch is used, it will certainly fail. German silver wire of 22 or 24 gage, properly annealed by investing it in plaster and pumice and heating for fifteen minutes with a blowpipe, will give exeellent results. It seldom breaks, and does not stretch.

Dr. Patterson. I had a case of fracture, about thirty years ago, where all the teeth were in the mouth. I wired the upper to the lower in beautiful shape, but the patient's mouth was so swollen it was pretty hard to get a tube around baek of the third molar for the purpose of administering his liquid food. How do you get along with your feeding? If everything is clear sailing, some teeth missing on one side of the mouth, you can get the tube in and feed the patient pretty well; but where swollen, or all teeth are present, it is very difficult. You have to keep those wires on how long? With a splint, we have perfect relief from all that sort of thing.

Dr. Black. I see absolutely no reason for difficulty in feeding in any case where the teeth are wired together, whether any of the teeth have been lost or not. Anyone can demonstrate this by drinking liquid foods with the teeth held tightly together. I have had patients go for fourteen weeks in that way, and keep in good condition, taking light exereise.

The Chairman. Dr. Marshall is obliged to attend the meeting of another section, and wishes to close the discussion at this time.

Dr. Marshall (closing the discussion). If I had the time I would try to maintain every position that I have taken. There are two or three points I want to speak of: This apparatus of Dr. Greene's is very good, and it does the

work. But I have never seen a lady yet who would allow me to put such an apparatus in her mouth—or any other patient, in fact. The principle is all right and it does the work, but it is such a cumbersome thing, so complex and unsightly that my patients would not allow me to use it.

Dr. Gilmer, I think it was, criticized the method of wiring the jaws and adjusting the fracture bands. But there are certain cases, gentlemen, which you cannot treat successfully without wiring the bone, and others which are more easily and successfully treated by using Dr. Angle's fracture bands.

Dr. Gilmer. I do not contradict that.

Dr. Marshall. It was Dr. Patterson, then. There are cases that cannot be treated successfully in any other way than by wiring the bone.

Dr. Roe took issue with me about the case of reunited fracture of nine months' standing. That case was one of fracture from a blow upon the side of the face. It came from the Philippine Islands, where it had been treated without obtaining union and the patient was later invalided home to the General Hospital and turned over to me. Several methods had been used in that case—wiring the teeth together, and the interdental splint. In this case the interdental splint could not replace the ramus in its normal position. It was out of position and held there by fibrous union, and the only way in which it could have been treated and the parts brought into normal apposition was by cutting down upon the bone, removing the fibrous tissue, drilling the ends of the bone, and wiring the ends together.

The interdental splint cannot be used in any case of fracture of the ascending ramus; because the action of the temporal muscle draws the end of the fractured ramus forward, and the internal pterygoid muscle draws it inward, and you cannot hold it in position by such an apparatus or by using the upper jaw as a splint, and wiring the jaws together, as Dr. Gilmer does, and as I have done with the Angle fracture bands.

I have to take issue with the statement of Dr. Patterson. I believe the Angle fracture band a most beautiful apparatus for treating certain kinds of fracture—only simple fractures, however. I have never used one for a compound fracture that had much displacement, neither have I used one in a multiple fracture; but in simple fractures they are very serviceable and get rid of all toggery on the outside of the mouth.

Dr. Roe spoke of fractures not being united in three or four weeks, and said he had never seen a case in which he could not get motion at end of that time. I have seen many. I did not say "consolidation," I said union. There is a great deal of difference between union and consolidation. If I had said consolidation, then I would have meant that the bone had become hard like the other bone. In the union of a fracture there is a formation of cartilage which will eventually become consolidated into bone. I have known fractures to unite in three or four weeks—yes, in 17 days. I have known of fractures united in that time so completely that there was no perceptible movement at the site of the lesion. Those cases are on record. I believe Dr. Roe also said he never saw a case that could not be treated by the interdental splint. I have seen a good many that could not be so treated. For instance, in fractures through the ascending ramus, near the angle, just back of the third molar, an interdental splint will

not bring the occluding surfaces of the teeth absolutely together—it is impossible; the appliance sets the jaws apart by just the thickness of the material left between the teeth, and a V-shaped space results at the point of fracture, and when it has united, the teeth do not occlude at the anterior part of the jaw. In the cases I have treated by the other method they do occlude.

Dr. PATTERSON. Grind off the occlusal surfaces of the splint—the easiest thing in the world.

Dr. ROE. The interdental splint I use in all cases with a fissure cut in so that the teeth are not separated one particle; the splint is made with the teeth in occlusion.

Dr. MARSHALL. I was criticized also for using the wiring method within the mouth. Now, Dr. Gilmer said he would not use it because it brought about extra traumatism and infection. Of course it brings about extra traumatism but not necessarily an increased infection, and I never use it unless I have points of fracture where infection is already present, viz, compound fractures. I would not use it in a simple fracture. It is used in cases where the external tissues are lacerated and where there is a great deal of displacement, the muscles pulling both the fragments into abnormal apposition.

Dr. GILMER. I want to ask this question of Dr. Patterson: He made the statement very broadly that there was no case at all that he could not treat with the interdental splint alone, without wiring together—

Dr. PATTERSON. I said I wanted to see them. I never had a case.

Dr. GILMER. I wanted to ask him how he would treat this case without wiring: A fracture of the neck of the condyle; a fracture at the angle; a fracture at the region of the canine tooth on the opposite side; a fracture in the ramus, the upper jaw broken entirely in two and entirely loose from its connection above, and the parts projecting?

Dr. PATTERSON. I would make a splint. Of course if the fracture is in the ascending ramus the pulling of the temporal muscle would, I suppose, displace the fragments. I am speaking of my own experience, which is quite broad, but I never had such a fracture as the one mentioned. The gist of the matter is, do you wire the fragments in fractures of the condyle? No, the splint would be used, and by bringing the teeth together the desired result would be obtained; but if there is so much displacement as in the case shown by Dr. Marshall, I do not know what I would do except to wire. But in a fracture back of the third molar, or a fracture at the condyle, certainly I would use a splint.

Dr. GREENE. I have had occasion to use this apparatus of mine twice, and it answers very nicely. When Dr. Marshall says he never had a patient who would allow him certain things, I do not think Dr. Marshall takes the right stand. I never ask a patient what to do. Patients are not competent to judge.

In certain cases I can see where wiring will work nicely. I think if Dr. Marshall could only, after he has put on the appliance he has described, take it off, and put on this appliance of mine which would allow the patient to move his jaws, the patient would be pleased.

THE CHAIRMAN. I feel, in the absence of Dr. Angle, that someone might justly add a word in support of what is known as Dr. Angle's splint. I wish to say that there is no reason in the world why in cases in which the line of fracture

is clean—when not in any way comminuted, and not a multiple fracture, they cannot be advantageously treated by at least one of Angle's methods. I see no reason why bands cannot be satisfactorily adjusted; not to the next tooth on either side, because the point raised by Dr. Patterson is a practical one for the reason that the teeth are usually loose on either side—but two or three teeth removed from the point of fracture on either side, with good long tubes soldered to these bands in a parallel direction. With screw bar and nut to hold, this gives absolute fixation of the jaws; there can be no movement of that mandible, or anything to interfere with union. Also one is able to reach the surface of the mucous membrane, to keep it clean and reasonably aseptic. Thus the patient can go about his work when the inflammation due to the traumatism has subsided, and may also be allowed to use the jaw for mastication to some extent.

In making a splint, I try to keep in mind, first, immobilization, and a fair approximation of the fractured parts with good occlusion, and second, facilities for thoroughly cleansing with antiseptics, and for examining occasionally, if possible, the surfaces of the mouth in the vicinity of the fracture. Also, while true that patients are able to live a long time on liquid food, it is very disagreeable to be required to do so, and if able to take solid food, it certainly is an advantage. Then one should, if possible, view the surfaces of the adjacent teeth from time to time to know whether devitalization of the pulp has occurred, and be able to remove the septic condition by thoroughly cleansing the canals.

I believe that is what Dr. Roe accomplishes with the interdental splint more than any others with the wiring appliances which require the fixation of the jaws together, and such a method as the latter I believe should be used with a great deal of judgment.

Dr. B. C. Nash, New York, N. Y. A method of splinting was shown by Dr. D. Genese of Baltimore, at a First District Society meeting, which consisted of first ligating the teeth with gilling twine —then securing an impression to which was applied a splint made of the ordinary metal strips used for polishing between teeth, a number of thicknesses being put together and soldered until a rigid splint was obtained, through which holes were drilled for ligatures. The attachment was made with gilling twine, and tension insured by split shot. To reinforce the splint, a pad filled with plaster of Paris was applied to the chin and a bandage drawn up over the head. It was only necessary to have this bandage in place for three or four days, when the patient was able to use the jaws to a certain extent. A full description of this method was published in *Cosmos* for May 1904 (vol. xlvi, p. 387).

Dr. Keefe. We have our wire enthusiasts and our splint enthusiasts. I am a splint enthusiast. I cannot see why you want to wire the two jaws together. Why not use a little aluminum splint cemented to the mandible, and the patient can go about as usual. I think Dr. Patterson's criticism regarding the Angle band was not applied to the one Dr. Brown referred to. It is the one that connects both jaws together that Dr. Patterson talked about, as I understood.

Dr. Patterson. That is right.

Dr. Keefe. I certainly agree with Dr. Patterson on that point.

Adjourned until Thursday, September 1st, at 2.30 P.M.

SECTION V—Continued.

THIRD DAY—Thursday, September 1st.

The section was called to order by the chairman, Dr. George V. I. Brown, of Milwaukee, Wis., who invited Dr. James M. Magee, of St. John, N. B., to preside as honorary chairman.

The proceedings were commenced by the reading of a paper by Dr. E. S. Talbot, of Chicago, Ill., entitled "Etiology of Cleft Palate," which here follows:

Etiology of Cleft Palate.

By EUGENE S. TALBOT, M.S., D.D.S., M.D., LLD., Chicago, Ill.

Beautiful as is the human face in its most perfect phase, it yet is, from the standpoint of food-getting, as Minot has shown, an embryonic type. The jaws are needed less and less for purposes of food-getting, chewing, and combat, hence the resultant disuse sacrifices them under the law of economy of growth, for the benefit of the growing brain and nervous system, and to meet the need which the first of these has of the dermal elements of the skull. Under the operation of the law of economy of growth there has occurred the esthetic evolution of the face from the anthropoid to the Apollo Belvedere type, as well as the reverse phase of this, where symmetry of the body as a whole, to preserve brain gains, is sacrificed to changes in the nose, jaws, alveolar process, and teeth. This struggle for existence strains most developments of points of ossification, and as it is aided by primitive type heredity, spends much of its force on the structures which have gained for race purposes, like the jaws and the teeth. The palatal bones are therefore affected.

Cleft palate is divisible into congenital and post-congenital. The post-congenital, while having a predisposing factor of teratologic nature, is often produced by a determining nosologic factor. Congenital cleft palate is divisible into two kinds, complete and partial: *complete*, when the fissure extends the entire length from the uvula to and including the anterior alveolar process and even the lips; *partial*, when only a small part of the structure is involved. Thus the cleft may extend through the anterior

alveolar process involving only the incisive bones, which is very rare; when present, single or double hare-lip almost invariably coexists. Cases occur where a small portion of the anterior alveolar process and jaw are involved with one or two teeth. The hard palate may be merely involved to the extent of a small fissure, or the whole palate may be wanting. The soft palate may contain the cleft, or the uvula alone may. Cases occur in which the non-development of the intermaxillary bones produces lip fissures.

The problems involved in cleft palate are those of embryogeny as modified by the law of economy of growth, by remote atavism, by type heredity, and by the results of characters acquired during the periods of dentition and adolescence, and prior to the senile stage. As soon as the external nares are separated from the mouth in the embryo, there occurs, as Minot has shown, a partition between the nasal pits and the mouth. This partition, in which the intermaxillary bone is differentiated later, is supplemented by another partition, the true palate, which shuts off the upper part of the oral cavity from the lower, thus adding the upper part to the nasal chamber. The palate is a secondary structure which divides the mouth into an upper respiratory passage and a lower lingual or digestive passage. The palate arises as two shelf-like growths of the inner side of each maxillary process and is completed by the union of the two shelves in the median line. The shelves so arch as to descend a certain distance into the pharynx, but in the pharynx their growth is arrested, though they may be still recognized in the adult.

In the region of the tongue, which includes more than the primitive invagination of the oral cavity, the palate shelves continue growing. At first they project obliquely downward toward the floor of the mouth and the tongue rises high between them, and appears, in sections which pass through the internal nares, to be about to join the intranasal septum. As the lower jaw grows, the floor of the mouth is lowered and the tongue is thereby brought farther away from the intranasal septum. At the same time the palate shelves take a more horizontal position and pass toward one another above the tongue and below the nasal septum, and meet in the median line, where they unite. From their original position the shelves necessarily meet in front (toward the lips) first, and unite behind (toward the pharynx) later. In the human embryo the union begins at eight weeks, and at nine weeks is completed for the region of the future hard palate, and by eleven weeks is usually completed for the soft palate also.

The palate shelves extend back across the third and second brachial arches. By migration of the first gill pouch, or in other words of the Eustachian tube, the Eustachian opening comes to lie above the palate (uvula), while the second cleft remains lower down and lies below the palate as the outline of the tonsil. The uvula appears during the latter half of the third month as a projection of the border of the soft palate. Soon after the two palatal shelves have united, the nasal septum unites with the palate also, and thereby the permanent relations of the cavities are established.

In dealing with the influence upon embryogeny of the factors named, the influences of disturbances of balance at an early period, which would strengthen disappearing structures at the expense of later acquired structures, have to be

considered. Such a disturbance would overcome the effects of disuse and create overgrowths of primitive structures at the expense of later acquired structures, leading to arrest, atrophy, or even disappearance of these last. The structures of the mouth and nose being exceedingly variable in evolution, and the structures of the jaws and teeth having in man taken an embryonic trend for the benefit of the body as a whole under the operation of the law of economy of growth, disturbances of balance are peculiarly apt to occur here. Not only is actual growth upset by the operation of this disturbance of balance, but certain potentialities are likewise interfered with. Up to the age of three years the central nervous system gains at the expense of the other structures. After this period the other structures gain, but the nervous system, while growing, does not maintain its supremacy in growth.

Interferences with palate formation must begin comparatively early in embryogeny, and hence must imply decided defect on the part of the parents. Any maternal factor, whether arising during a particular pregnancy or inherited, may so check the development of the palate as to produce the various types of deficiency which are observed by surgeons. The influence of heredity requires no special discussion, since it is involved as a rule in serious general defect rather than in localized. Furthermore, maternal environment plays here as elsewhere an enormous part. A defective mother may be so influenced by favorable environment during the first three months of pregnancy, or by removal from bad parental environment during the same period, that the embryo would not only pass through these periods of intra-uterine stress successfully, but would likewise acquire increased potentiality of passing through the later periods successfully. On the other hand, an evil environment, or an environment changed for the worse soon after impregnation, unfavorably affects embryogeny.

In dealing with the development of the palate, both pre- and post-congenitally, the relations of the hypophysis or pituitary body have to be taken into account, since it has been well demonstrated that this body exerts an influence over body growth and the structures thereto related. The hypophysis arises in all vertebrates as an evagination of the ectoderm near the dorsal border of the oral plate, but is separated from the plate by a fold of the ectoderm. The hypophysis at one stage of its development in mammals is a diverticulum of the oral cavity with one wall attached to the brain and the other formed by a fold dividing the hypophysis from the mouth. The hypophysial diverticulum later elongates and its upper end expands to a considerable vesicle, the lower end remaining narrow as the pedicle. The floor of the brain forms an outgrowth behind the hypophysis, which is the representative of the infundibulum. The cementing together of the buccal and cerebral ectoderm over the hypophysial area causes the formation of the two diverticula. The hypophysis then grows rapidly; the pedicle elongates and its lumen is obliterated. The mesenchyma condenses to form the base of the skull (sphenoid). The pedicle entirely aborts, but the position for its passage through the sphenoid, while remaining for some time after birth, in about 10 per cent. of children dying in hospitals is ultimately obliterated by the growth of the sphenoid cartilage.

The infundibulum contributes to the

production of the adult hypophysis in mammals, but in lower vertebrates it persists as an integral part of the brain, and is differentiated into ganglionic tissue. The pointed end undergoes a knob-like enlargement which later loses its cavity. Although the differentiation of nervous tissue begins in it, its cells early acquire an indifferent character. It is penetrated by bloodvessels and connective tissue, but the connection with the brain is permanently retained. In the adult the knob, although regarded as the posterior lobe of the hypophysis, is in no sense a part of it. Strain on the development of the hypophysis after birth can not only produce undue growth of bone, but can also check development of it. The influence of the periods of stress during the last months of pregnancy may arrest palatal development, due to interference with the bone-forming function of the hypophysis checking the development of bone and cartilage necessary to proper evolution of the palate.

"The antecedent," according to Oakley Coles, "which strikes one *a priori* as being likely to play the most important part in the production of congenital deformities is that of hereditary influence. But though it will be evident that the direct influence of heredity in the production of cleft palate is marked and undeniable, no sufficient statistics have as yet been brought forward to show that the actual presence of deformity in the parent has any direct predisposing influence on the child. In other words, though the defective conditions which precede and accompany the phenomenon of cleft palate are almost certain to be referred to parental influence, it is extremely doubtful whether cleft palate is in itself transmissible."

Here appears that antiquated view of heredity which takes into account only direct transmission. Heredity involves the complex of type heredity, remote atavism, individual defects or peculiarities of immediate ancestors, maternal environment and stress period environment. Direct heredity can operate only when, in embryonic existence, by the law of economy of growth, the embryogeny is centered around a given line of least resistance during the struggle for existence between the organs for assimilable nutriment. While a defective ancestor may have defective children, the line of direct expression of the defect is interrupted by the influence of atavism, by the influence of varying environment during embryogeny, and during postnatal periods of evolutionary stress. That cleft palate may be transmissible, Demarquay, Roux, Trélat, Follin, and Duplay have shown, but such transmission is and must be rare, from the factors unfavorable to direct transmission entering into heredity, inclusive of maternal environment during embryogeny.

The deformity rarely occurs if at all, from maternal impressions. In most of the cases which have come immediately under notice, when one parent had a cleft palate all the children have been born perfectly developed, even though dread of transmitting the deformity was never absent from the mind of the mother. In one case, three members of one family have cleft palate—one seventeen years, another thirty, and the third thirty-five. The first and last are women, the other is a man, married and with a family without any trace of the father's deformity. No instance of cleft palate could be found among ancestors or collateral branches of the family. In another family I have obtained the following remarkable history: G. H. C., born 1853;

perfect. L. C., born 1855; single hare-lip and cleft palate. J. F. C., born 1856; perfect. F. W. C., born 1860, double hare-lip and cleft palate. H. E. C., born 1863; perfect. The paternal grandmother had cleft palate.

Five per cent. of 1200 criminals examined by Knecht had cleft palate. In an examination of 495 criminal boys at the Illinois State Reformatory and 1080 at the New York State Reformatory only one case in each institution was observed. Fourteen per cent. of the prostitutes examined by Pauline Tarnowsky had cleft palates. Langdon Down found only ½ of one per cent. of cleft palates among congenital idiots. Gresnor found nine cases in 14,466 children, or one in 1607. I examined 1977 feeble-minded children without finding a single case. In 207 blind, but one case was observed; in 1935 deaf mutes two cases, or about one in 1000. The percentage among the defective classes is undoubtedly much larger than among normal individuals, but early deaths explain the small percentages.

Bland Sutton's experiments with dogs indicate not only the presence of this deformity among animals, but its transmission. Hereditary defects are evident in the statistics of zoölogical gardens. A keeper of the Zoölogical Gardens in Philadelphia observed cleft palate in the mouths of lion cubs born in the gardens. Cleft palates were also observed in a number of pups born in Buffalo. Ogle found that ninety-nine per cent. of the cubs born in the London Zoölogical Gardens had cleft palates. This was ascribed to the artificial diet of the mother as the result of enforced captivity. Similar results in other gardens in Europe were charged to maternal feeding with meat without bones. Feeding with the whole carcass of small animals greatly diminished these deformities. If cleft palates were sometimes attributable to this cause, other bony structures should likewise be involved. It is hence not astonishing to find many rhachitic lions born in captivity. Cleft palate has been observed among dogs, sheep, goats, etc. The question whether domesticity does not have in them the alleged parasitic influence of civilization in man can only be solved by knowledge as to the frequency of deformity among wild animals of the same zoölogical families.

The difficulties of securing data of the occurrence of cleft palate among wild animals are sufficiently shown by the following replies to the question: *Have you ever observed cleft palate among wild animals not in captivity?*

Professor Osborn is in Europe, but in his absence I have attempted to find an answer to your query in regard to cleft palate. I looked through Windle's 11th to 15th "Report on Recent Teratological Literature" (*Journal of Anatomy and Physiology*), and also in several encyclopedias and surgical books, without success; I also asked Dr. J. A. Allen, one of the leading mammalogists of the country, if he had ever noted cleft palate in wild animals not in captivity, but he had never noted a case.—Wm. K. Gregory, American Museum of Natural History, New York city.

In reply to your query, I can say that I have never observed and do not recollect having heard of a case of cleft palate in wild animals not in captivity.—J. Symmington, Queens College, Belfast, Ireland.

I have not seen a case of cleft palate in any wild animal.—Wm. Turner, Edinburgh.

I have never observed a case of cleft palate among wild animals nor have I ever heard of one. Several years ago, lion whelps were born with cleft palate in the Zoölogical Gardens of London.—Bland Sutton, London.

I have only experience of wild animals bred in captivity. In the Zoölogical Gardens of Dublin, which I had the supervision of for

many years, we have bred lions (between 200 and 300) since 1856. Only very occasionally did cleft palate or other deformity appear among the cubs—only once during my time, if I recollect rightly. Of course in my museum work I have had many wild animals pass through my hands which were not bred in captivity, and I never saw a case of cleft palate. At the same time it should be remembered that many collectors would reject a deformed specimen.

In the London Zoölogical Gardens, cleft palate among lion cubs used to be very common, I understand.—D. J. Cunningham, University of Edinburgh.

In reply to your letter of the 1st instant, I know of only one case of wild animals being born with cleft palate; the knowledge of this I owe to Mr. R. T. Powch, superintendent of these gardens. He informs me that a litter of tiger cubs born of wild parents were brought up by an English lady in Burmah and found to have cleft palate. As you perhaps know, lion cubs have so constantly a cleft palate that it seems almost if not quite normal for them to be so born in menageries. —Frank E. Beddard, Regent's Park, London.

In conversation with Mr. Hagenbeck of Hamburg, who has a large menagerie of wild animals, and who furnishes the zoölogical gardens of the world with their material, he informed me that he had never seen or heard of a case of cleft palate among wild animals.

This negative evidence is not equivalent to demonstrating the absence of cleft palate among wild animals, for, as I have elsewhere pointed out, animals destroy, soon after birth, offspring which to them appear peculiar. Cleft palate predisposes to infection by pathogenic bacteria and hence offspring born in a wild state are not likely to survive. Cleft palate, moreover, is quite frequently associated with deep-seated affections of the nervous system or of the locomotive apparatus.

In the evolution of the palate, ossification is the central point as regards completed development. Arrest of ossification, or of its potentiality, plays a considerable part in determining the permanence of cleft palate. Reported cases show that the condition is one which sometimes requires merely a temporary stimulus to growth to disappear. The arrest is one of potentiality, not of permanent development. The palate bone develops from a single center at the angle of junction of the two plates of the bone.* The center makes its appearance about the second month. Appearing thus early, it has an impetus which survives the stress of the different periods of intra-uterine development and maternal environment. The influence of type heredity aids rather than arrests ossification of the palate, since tendency to ossify occurs thus early.

The relationship between palatal vault deformities and cleft palate, pointed out by Oakley Coles, is that existing between atrophies, hypertrophies, and arrests of development everywhere. Instability of trophic functions is shown as much in hypertrophies as in atrophies. The instability may affect not only development but potentialities of development, which it may arrest ere the period when the potentiality is to pass into fulfilment. The same factor which prevents sexual development at the period of puberty may prevent proper development of the vault at the sixth year. The frequency of what may be called palatal hypertrophy as compared with the deficiency shown in cleft palate is an illustration of this impetus. The ease with which the tendency to cleft-palate offspring is remedied by diet in the menageries shows that the ossification potentialities need

* "Gray's Anatomy."

but a slight stimulus. Influences interfering with proper development of the hypophysis, which is in such close embryogenetic relations with the palate, interfere with the onset of ossification, or with its proper development.

From the angle of junction of the two plates of the bone, ossification spreads inward to the horizontal plate, downward into the tuberosity and upward into the vertical plate. In the fetus the horizontal plate is much longer than the vertical, and even after it is fully ossified the whole bone is at first remarkable for its shortness. The palate hence requires an additional period to develop after ossification. The complicated relations of the palate to the turbinated and maxillary bones, both under stress from the law of economy of growth as varying structures, place it under varying conditions of nutriment, expressed either in excess or in the deficiency shown in cleft palate. The fact that the palate is permanent compared with the turbinates and the rest of the maxillary bones, indicates that, aided by its early ossification tendencies, it tends to survive in the struggle for assimilable nutriment. Heredity of long standing, however, sometimes so affects early development of the palate as to give the other two bones an advantage. This occurs where the pre-conceptional vitality of the mother is lowered, or where the first two months after conception are periods of extreme maternal strain. Paternal vitality when lowered affects the early conceptional period. This, to some extent involves an influence on maternal vitality, since, as has been repeatedly shown, chiefly after maternal breakdown does paternal defect show itself. In Mongoloid idiocy, as W. A. Hammond* has shown, early pregnancies when the mother is healthy are free from such offspring, but later births are of this type.

To such an extent is this maternal vitality in evidence that even syphilis may not arrest development. Thus, as in a case reported by Engel,* the husband may be infected during the second month of his wife's pregnancy and immediately infect her. A hearty boy is born with copper-colored eruption about the anus and later coryza. These symptoms disappear under specific treatment, not to return. The child does not have tertiary lues, but, unlike the ordinary cases of congenital syphilis, the secondary stages.

The factors involved in the reproduction of congenital cleft palate are, it is clear from the foregoing facts, partly of an embryogenetic nature which is connected with ossification evolution—which last, in turn, is involved in hypophysis development. These factors are not necessarily connected with heredity, albeit the influence of maternal environment cannot be completely excluded. The influences checking palatal development must be present very early in embryogeny, since the palate ossification center is quite early in evidence. The factors affecting this ossification center may entirely arrest ossification, may arrest it irregularly, or may merely arrest its potentiality. In the latter case improved maternal environment has favorable results. In hereditarily defective cases, however, there is an irregularity of balance giving an undue sway to certain early acquired structures at the expense of others later acquired, which leads to increased irregularity rather than to its

* "Neurologic Contribution."

* Kassowitz, *Jahrb. f. Kinderheilk.*, B. xxi.

disappearance. The influence of hypophysis extracts on deficient osseous development is as yet merely suggested; sufficient is known, however, to indicate that it might be well to use hypophysis extract in cleft palate, proceeding on the possibility that the arrest was merely an arrest of potentiality, not an arrest of growth.

Discussion.

Dr. J. G. Kiernan, Chicago, Ill. There is one factor to which Dr. Talbot has called attention that has not hitherto been considered in connection with facial development and degeneracy. This deserves the more attention because it opens up a therapeutic possibility. That the hypophysis has relations with bone growth is now generally admitted. That it produces abnormal growth at the expense of the organism is also admitted. The corollary from this, that what produces abnormal excess may supply deficiency has not yet been acted on in the case of structures where this corollary is indicated. The relationship of the hypophysis to facial development decidedly indicates the use of hypophysis extracts in cleft palate and allied states. It must be remembered that, as shown by the results of operations, many of these states retain potentialities which need only a slight stimulation.

The Chairman. If there is no further discussion, we will consider the subject passed. The secretary desires to read some papers by title.

The Secretary. I have here a paper by Dr. Thomas Fillebrown, of Boston, Mass., entitled "Anesthesia for Oral Operations." Dr. Fillebrown is unable to be present at this meeting.

The paper in full here follows:

Anesthesia for Oral Operations.

By THOMAS FILLEBROWN, M.D., D.M.D.,

PROFESSOR OF OPERATIVE DENTISTRY AND ORAL SURGERY, HARVARD UNIVERSITY.

The difficulties attending the maintenance of the anesthetic state during surgical operations in and about the mouth are too apparent to need any description. In most cases more time is occupied in waiting for the administration of the drug than is taken up by the operation. Nor can an even anesthesia be maintained, as it is of course necessary to remove the inhaler from the face while the operator proceeds. By the ordinary methods of giving ether or chloroform an intermittent anesthesia is the best that can be produced. I suffered so much annoyance on this account that I tried the Junker method and injected the ether vapor through the nares. One trial proved that with so much blood and mucus in the throat as gathers during a cleft palate operation the apparatus was quite inadequate, consequently I set myself to work to devise one that would accomplish what I desired.

My first effort was successful. The apparatus is shown in Fig. 1, reproduced from the *Dental Cosmos* for December 1895.

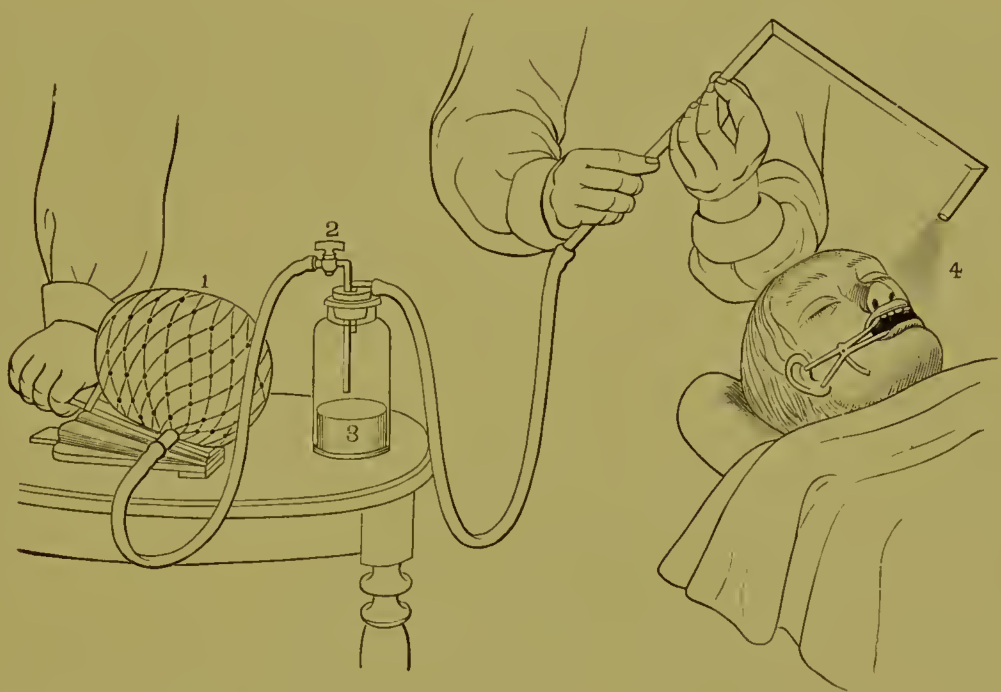
The current of vapor issuing from the

tube is so large that it leaves no margin of air for the patient to breathe. A mouth-gag is essential to success with this apparatus. It is also essential that the tongue be drawn forward as described farther on. When the retractor tube is used, it is very important that the nostrils be plugged, to prevent inspiration through the nose. Sometimes patients are inclined to close the throat and breathe through the nose, thus inspiring air unmixed with ether.

With this simple apparatus complete anesthesia may be maintained for any length of time while any operation on the face or within the mouth of the patient is being performed, and the operator will not be interfered with any more than during an operation on any other part of the body. An assistant can use the sponge freely and keep the throat clear of blood and mucus. Fig. 1 shows all the parts, and will make the explanation clear.

The *management of the tongue* is of great importance in oral surgery. It is our invariable practice to secure control of this organ by a ligature passed through the tip, of sufficient length to be held by an assistant some distance away. In this way the tongue is continually under control, and by gentle traction free respiration can be constantly maintained and stertorous breathing avoided. We are also enabled to remove clots, blood, and mucus from the throat with greater facility. Furthermore, a depressor can be used without crowding the tongue down over the glottis.

Fig. 1.



Later I have used a warm-water bath to keep up the temperature of the ether, which will soon by its own evaporation become so cold that it will not evaporate freely, and the air which is delivered to the patient will not be fully saturated with the anesthetic vapor. This is all that is essential for any one anesthetic.

For convenience I have attached to the

water bath a second wash-bottle to contain chloroform or other drugs, so that it is always ready for use. I have also devised a valve that controls the strength of vapor passing to the patient. This has proved very satisfactory, as many patients require but very little anesthetic and sometimes, for quite a period, almost none.

Fig. 2.

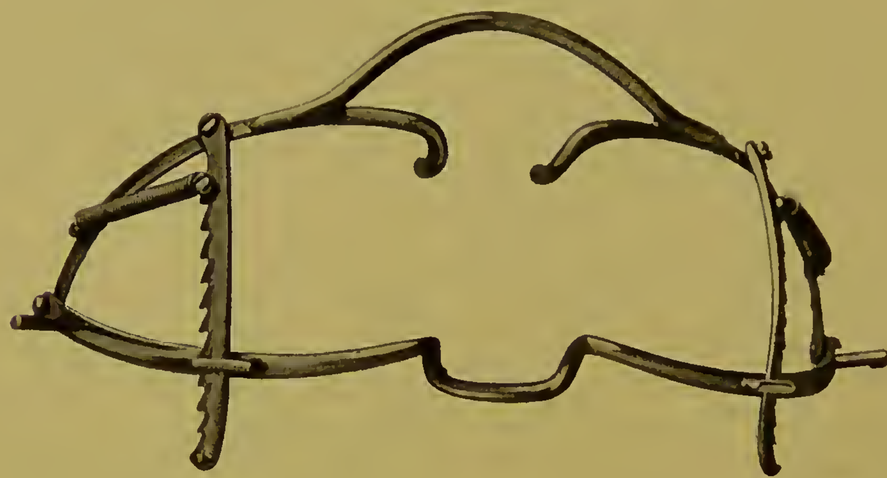
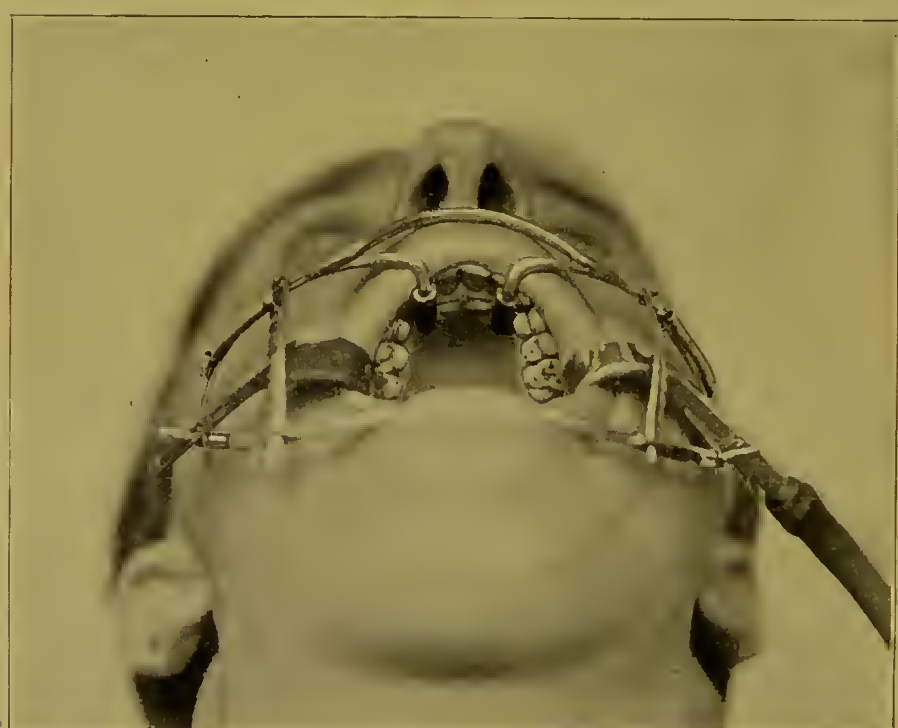


Fig. 3.



For my own use I have connected the bellows and tubes with both bottles by a Y tube so that by the turn of a valve I

can change from one anesthetic to the other, or give a mixture of the two. (See Fig. 4.) I have also substituted the small double-action foot bellows for the large one formerly used, and find it much better. At the suggestion of Dr. C. D. Fillebrown I constructed another delivery attachment adapted to the Whitehead mouth-gag. This is formed from a metal inward, while at the other end the perforated plate is adjusted loosely over the pin projecting from the gag, producing gentle outward traction. In this we have a combined delivery tube and retractor, which having once been adjusted requires no other further attention.

For retracting the other side of the mouth a thin plate was made with the

Fig. 4.

tube four inches long and flattened for about two-thirds of its length. This portion is formed on the plan of a fish-hook, and has a lip extending a little beyond the flattened orifice in the line of concavity. The other end secures the end of the rubber tubing from the bottles, and is provided with a small plate soldered on lengthwise containing two perforations. This attachment fits nicely into the corner of the mouth with the extension lip resting against the inner side of the cheek and the orifice directed same curves and perforations as the former, and secured in the same way on the other side of the gag, with two points of attachment furnished by the perforations in the stem of the retractor. The tension can be regulated to adapt them to mouths of different sizes.

I found the Whitehead mouth-gag for general use to be the best made, on account of its self-retaining quality. The tongue-depressor attachment I at once removed, as it pressed the tongue back and obstructed the breathing. I also

found the continuity of the wire across the palate a hindrance to reaching an anterior fissure of the palate.

My modification of the Whitehead mouth-gag has remedied this by removing a section at this point and turning the remaining ends in such a manner that they would impinge upon the palatal surface of the mouth and some of the anterior teeth, whatever the size or shape of the arch. The strength of the bar thus sacrificed was restored by a bow of heavy wire brazed on at points some distance out on each side. As a result of this change nothing presents for a considerable width in the median line, and the field is unobstructed, while the self-retaining qualities of the gag are preserved. Fig. 2 shows the gag as improved. To accommodate a wide lateral fissure the points may be moved a little to the right or left as the case demands without disarranging the instrument.

Fig. 3 shows the gag adjusted in the mouth with the retractor and vapor tube attached.

Finally, to enumerate the merits of this modified Whitehead gag, we have here an instrument which combines lightness and strength, having curves which conform to the face and present no awkward projections. It may be used in mouths of any size without alteration. With cushions on the impinging points it may be applied successfully to edentulous subjects of all ages. Its adjustment is easy, and it is self-retaining. I have used this gag successfully and conveniently during a lengthy operation in the mouth of an infant ten months old.

Fig. 4 shows the apparatus entire, the bellows being placed on the table to bring it better into view in the photograph.

The apparatus is now made and is for sale by a responsible concern and is at the present time used in at least four of the public hospitals in Boston and in a number of private institutions.

The mouth-gag as improved and an apparatus as described makes the operation for cleft palate much shorter in time and easier of manipulation.

The Chairman announced as the next order of business the reading of a paper entitled "The Importance and Methods of an Early Diagnosis in Malignant Tumors of the Maxillary Bones," by A. HAMILTON LEVINGS, M.D., professor of oral surgery, Wisconsin College of Physicians and Surgeons, Milwaukee. The paper here follows:

The Importance and Methods of an Early Diagnosis in Malignant Tumors of the Maxillary Bones.

By A. HAMILTON LEVINGS, M.D.,

PROFESSOR OF ORAL SURGERY, WISCONSIN COLLEGE OF PHYSICIANS AND SURGEONS, MILWAUKEE, WIS.

THE importance of an early diagnosis in the case of a malignant tumor affecting one of the maxillary bones, its periosteal covering, and the muco-periosteal lining of the antrum, can scarcely be overestimated. Upon an early diagnosis may rest a very conservative and still successful treatment in the case of the mildly malignant growths. In tumors which are decidedly malignant an early

diagnosis is absolutely essential in order that the patient's life may be saved by timely operative interference. It is pretty well established that in some of the giant-cell sarcomata, invasion of surrounding structures or metastasis does not occur for a few months, or perhaps during the first year. On the other hand, in many of the round-cell sarcomata and in some of the endotheliomata and carcinomata, regional or distant infection is likely to take place during the first weeks or months of their growth. In these cases, if operation be deferred beyond this time it will be too late, ordinarily, to save the patient's life.

In the majority of the malignant tumors of the maxillary bones the first symptom is a pain in the jaw or in the tooth. Following this there may be swelling, and then ensues loosening of the tooth or teeth. With these symptoms the way is made easy for patient and dentist to consider the trouble as of no great moment, or as one which most concerns the tooth.

The importance of an early diagnosis is so great that in every case of pain in a tooth or in the jaw, especially if later associated with swelling of the gums or expansion of the bone, the physician or dentist should not consider himself as having done his whole duty to his patient unless he has exhausted every method at his command which could aid him in establishing a correct diagnosis. When one considers the disastrous results of delay in these cases, the responsibility resting upon the physician or dentist is very great.

Every case of tumor of the maxillary bone should be considered possibly malignant until it has been proved benign. At least half a dozen cases of round-cell sarcomata taking origin from the maxillary bones or their coverings have come under my observation in which treatment has been carried on for five or six months under the mistaken idea that the patient was suffering from necrosis or caries of the jaw, neuralgia, or chronic pyogenic infection. In other cases there has been no especial effort to establish a diagnosis, the cases being treated as of no great importance and expectantly until such time as the diagnosis might become clear. The case is usually then non-operable. In any case of odontalgia, or in any case in which there is a pathological process going on in the maxillary bones, any delay in making a diagnosis or in not using all the means for that purpose at our command is absolutely inexcusable—one might almost say criminal. An early diagnosis may be difficult, but an early diagnosis is possible in nearly every case if one be on the alert and fully prepared to use every means at his command for that purpose.

CLINICAL METHODS OF DIAGNOSIS.

In our efforts to reach a diagnosis it is of the first importance that we have a clear understanding of the symptoms and course of the malignant growths implicating the maxillary bones. We should, if possible, differentiate the malignant neoplasms not only from the benign but also from those pathological processes within the bones, periosteum, and teeth which are produced by infection or chemical action. The malignant tumors which implicate the maxillary bones or their coverings are the sarcomata, the endotheliomata, and the carcinomata. The sarcomatous growths are divided according to the shape of the cell into large and round-cell sarcomata, large and small spindle-cell sarcomata,

and the giant-cell sarcomata. It is necessary to keep these species distinct in one's mind, because the malignancy of these growths depends largely upon the shape and size of the cells.

As is well known, the sarcomatous growths take origin from the connective tissue, and in these situations they may spring from the periosteum covering the bone, from the alveolo-dental membrane, from the muco-periosteal lining of the antrum of Highmore, and from the osteogenetic layer lining the medullary or Haversian canals. They usually occur before middle life. A goodly number of cases have been observed even in young children. The patients often give a history of an injury which may have been the exciting cause. These tumors are not encapsulated or circumscribed, and only infrequently infect the adjacent glands. There are two varieties of sarcomatous growths which take origin from the periosteum. One of these is known as an epulis, the other as a periosteal sarcoma. The epulis is a soft, rather rapidly growing, well circumscribed, comparatively painless tumor, which bleeds easily, has a reddish color, takes its origin either from the mucous membrane of the gum at the border of the tooth or teeth, from the outer layer of the periosteum covering the bones, or from the alveolo-dental membrane lining an alveolus. The growth is in direct relation with the crown of one or more teeth, along which it is projected toward the free border. It may require several months, perhaps a year, to reach the size of a small almond nut. During this time, the teeth may be loosened in their sockets in consequence of the growth implicating the alveolo-dental membrane. It is to be differentiated from the fibroid epulis, which is much harder, grows slower, does not bleed readily, and is covered with a normal mucous membrane. Microscopically, the epulis is often a mixed growth containing giant and spindle cells, the former usually predominating.

The second variety of the sarcomatous growths take their origin from the osteogenetic layer of the periosteum or from the alveolo-dental membrane. They are consequently primarily situated between this membrane and the bone, or within a tooth-socket. Some of these tumors grow very slowly, others grow rapidly. They are oval, elongated, globular, and seemingly well circumscribed or diffused tumors which are immovably connected with the bone. They are quite hard and smooth, and usually have a pretty uniform consistence. In some cases, however, they are very irregular upon the surface, and may even contain cysts. If situated upon the inferior maxillary bone they may cover but a limited area or completely surround the bone. If taking origin from the alveolo-dental membrane of the superior maxillary bone they often invade and even fill the antrum or extend over the surface of the bone as an irregular mass. In one of my cases, that of a round-cell sarcoma, the process having begun in a tooth-socket of an ulcerated tooth spread rapidly along the gums to the tonsil and soft palate upon the inside of the jaws, while upon the outside it invaded the cheek and adjacent glands. The case was non-operable six weeks after its inception.

In a case of giant-cell sarcoma having the same origin, the process invaded the antrum and gums and spread along the anterior walls of the superior maxilla beneath the periosteum, producing a tumor of considerable size. This extent of growth was effected in about three months. A cure was attained by resec-

tion of the superior maxillary bone of that side. It is characteristic of many of these growths taking origin from a tooth-socket that they spread rapidly along the gums, infiltrating them and causing marked swelling. Some of the periosteal sarcomata are made up of giant cells, others of spindle cells, and others of round cells, or the growths may be mixed in character, containing perhaps round, spindle, and giant cells. A goodly number are osteo-sarcomata or osteo-chondro-sarcomata, in that they contain both bone and cartilage.

DIAGNOSIS.

The sarcomatous epulis is not likely to be mistaken for any other tumor, unless it be a fibroid growth in the same situation; but the increased vascularity, redness, softness, and accelerated growth of the former makes it ordinarily easy of differentiation.

A periosteal sarcoma other than an epulis is perhaps not so readily differentiated. When it occurs on the alveolar border of one of the maxillary bones or over the compact substance, it produces, as a first symptom, swelling which can readily be made out in consequence of the superficial position of the bone. This swelling is fixed, not well defined, and is slowly or rapidly progressive. The swelling is followed by pain which is seldom severe. Except in the most malignant cases there is no fever, or not more than one-half to one degree, and for weeks no glandular enlargement or special constitutional disturbance. It should be understood that the malignant tumors, after their inception, have a certain period of growth during which metastasis does not occur. This period may be represented by but a few weeks or by months. It is necessary, if the patient is to receive the greatest benefit from the treatment, that the diagnosis be made during this period—that is, during the first few weeks following the inception of the tumor. These periosteal sarcomata are not likely to be mistaken for fibromata, osteomata, cysts, or other benign neoplasms, in consequence of the very slow, indolent, and painless growths of the latter; but they must be differentiated if possible, and that very early, from other periosteal affections, such as acute and chronic periostitis of pyogenic origin and periostitis of tubercular, syphilitic, and chemical origin.

Pyogenic periostitis, if acute, comes on suddenly and is accompanied by intense pain, high fever, great tenderness, and marked constitutional disturbance. The very mention of the condition would readily lead one to differentiate it from a chronic periosteal process of sarcomatous origin.

Chronic pyogenic periostitis will give a history of some chronic inflammatory process with infection, such as a carious tooth, ulceration about the gums or within the mouth, or a trauma with infection. Less frequently the process will be due to an exanthematous or rheumatoid affection. In these cases there will be localized pain, swelling, and tenderness; swelling never marked, fever slight or absent, the condition not being progressive or leading to the formation of a tumor.

Chronic tubercular periostitis is a rare affection in this situation. There will be a circumscribed, slowly progressive swelling of the periosteum, with pain and localized tenderness. Fluctuation may be present, with tubercular pus formation. In these cases, if the process be situated over the alveolar process, caries

of the bone may follow. The affection never occurs in a healthy individual, but usually in one who has given other indications of tuberculosis. In the maxillary bones a syphilitic periostitis, though rare, occurs as a chronic process both in the acquired and inherited forms of syphilis. There may be a more or less circumscribed periostitis with the formation of a syphilitic node, or a syphilitic gumma may occur. There is usually a severe aching pain which is worse at night. The process is a slow chronic one, and the node when formed is oval, smooth, hard, elastic, and situated within the periosteum and upon the bone. Degeneration with softening and discharge of the gumma or node frequently takes place. The underlying bone is often primarily eroded, while the bone adjacent to the gumma becomes hypertrophied. Such a periosteal node of syphilitic origin, over the inferior maxillary bone, in a boy of twelve years, recently came under my observation.

There are some cases of chronic periostitis, especially those due to a trauma, in which new bone is formed beneath the periosteum. In these cases the new bone is simply a lamella, or splint, which is laid down beneath the periosteum. Where the symptoms and clinical course, however, are insufficient for diagnostic purposes, one should use the X ray. In the osteo-sarcomata, which are frequent in this situation, the picture will show spicules of bone, placed perpendicularly to the shaft. This is characteristic, almost pathognomonic, of this growth. Sarcomatous growths situated upon bone practically always produce more or less destruction of the underlying bone, no matter whether this bone be cancellated or compact. If the X ray shows destruction of the superficial portions of the bone, the condition is at least very suspicious and is almost certainly either sarcomatous, tuberculous, or syphilitic. When a study of the symptoms and clinical course and the use of the X ray are insufficient to establish a diagnosis, an exploratory incision should be made. This will show, in an osteo-sarcoma, a cellular mass, spicules of bone, and often areas of degeneration or hemorrhage with superficial caries. In a sarcomatous growth which does not contain bone the mass is soft, highly vascular, and cellular, with more or less erosion of the underlying bone. Often there will be perforations of periosteum and a diffused, not well circumscribed infiltration of the overlying tissues.

THE MEDULLARY SARCOMATOUS TUMORS.

These growths are of frequent occurrence. They take origin from the interior of the alveolar process and either from the osteogenetic layer of the medulla or from the tooth-socket. The symptoms will vary, a good deal depending upon the species. The giant-cell sarcoma, one of the most frequent, is a semi-benign tumor. It grows slowly, taking a year or more to reach any considerable size, and during this time may not produce metastasis or affect the health or well-being of the individual.

Pain is usually the first symptom indicating its presence. This is not severe, and often is mistaken for an ordinary tooth-ache. The pain is caused by the growth's exerting pressure upon the overlying bone, and it increases, though it seldom becomes excessive. In a short time a slight expansion of the jaw occurs from pressure within, and then swelling is to be noticed. The overlying tooth or teeth soon become loosened, the

swelling progresses, the pain increases, and the teeth are often extracted. During this period there will have been little or no fever and but slight functional disturbance.

The round and mixed-cell sarcoma taking its origin from the interior of the bone is often an extremely malignant tumor. It grows rapidly, invades and destroys the bone, reaches the periosteum or muco-periosteum, which it invades, and then infiltrates the overlying soft tissues. In these rapidly growing sarcomatous growths there is often a fever of one, two, or even three degrees, with loss of appetite and flesh. There will be weakness and other marked constitutional disturbances. As the tumor in its growth destroys the bone, the X ray will show a light area corresponding to the growth, while an incision will disclose a non-encapsulated, soft cellular mass. If the X ray does not show destruction of the bone an operation may be deferred, but if it does, an operation is imperative for differential diagnostic purposes. Malignant growths taking origin in this situation must be differentiated from neuralgia and the pain of carious teeth, from necrosis of the jaw, acute and chronic, such as pyogenic osteomyelitis, phosphorous, mercurial, arsenical, and exanthematous necrosis.

Neuralgia is easily differentiated, as the patients usually suffer neuralgic pains in other portions of the body or throughout the area of distribution of some branch of the fifth nerve. There is also an absence of swelling, loosening of the teeth, fever, and other pathologic condition within the jaws. Caries of the enamel leading to exposure of and inflammation of the dentin or pulp should not be mistaken for a growth within the bones. From my own experience I have reason, however, to know that these sarcomatous growths are often mistaken for and treated as cases of caries or necrosis of the bone. Acute diffused or circumscribed necrosis of pyogenic origin, with its sudden onset, swelling, intense pain, and fever, is not likely to lead one into error. The only processes likely to mislead, if one be at all cautious, are the cases of chronic necrosis and the benign growths taking origin within the bone.

Phosphor-necrosis, with its gradual onset as a diffused periostitis accompanied by the loosening of many teeth, with profuse suppuration and a history showing exposure to the fumes of phosphorus, will readily lead one to differentiate it from a sarcomatous growth.

Mercurial necrosis, occurring after the administration of large doses of mercury, is preceded by intense ptyalism. It comes on suddenly and is followed by marked swelling of the periosteum and gums and loosening of the teeth.

Arsenical necrosis may occur as the result of the application of arsenous acids within the cavity of a carious tooth, but in these cases the necrosis is very limited in extent and is usually confined to the alveolus of the affected tooth. The process is not followed by marked swelling. Cases of exanthematous and typhoid necrosis correspond in a measure with those of acute osteomyelitis, only that they are less abrupt in their onset and pursue a more chronic course.

A syphilitic gumma within the medulla, occurring either as the result of acquired or inherited syphilis, may lead to the gradual expansion and absorption of the bone and will be difficult of differentiation from a sarcomatous growth without a history of syphilis and without exploratory incision. A tubercular inflammation may occur in the interior of

the maxillary bones as the result of the implantation of the bacillus of tuberculosis and the formation of a tubercular node. The inflammation is very slowly progressive, the expansion of the bone gradual and seldom considerable. There is usually a limited area of tenderness in the overlying periosteum, often with fever and usually with a history of tuberculous processes elsewhere in the body. With central destruction of bone, the X-ray picture would show a light central area the same as in sarcoma; an incision, however, would establish the diagnosis.

DIFFERENTIATION FROM BENIGN TUMORS.

The benign growths which implicate the interior of the maxillary bones are the odontomata, fibromata, osteomata, the cysts, and the benign epithelial growths. The general characteristics of the benign growths are that they usually occur in young persons, and do not for a long time produce pain, expansion of the jaw, or loosening of the teeth. They never produce metastasis nor do they affect, except as the result of pressure or infection, the health or well-being of the individual. They are also comparatively rare, being much less frequent than are the malignant tumors.

The odontomata have also the further characteristics that they are usually associated with a non-erupted tooth or teeth and are congenital in origin.

The cysts which occur in the alveolar processes have their origin from the epithelial cells which were projected from the mucous membrane in fetal life into the subjacent tissues for the purpose of producing the enamel of the teeth. These columns of sequestered cells, when they have served their purpose, usually undergo degeneration and absorption, but when the conditions are favorable, they may multiply and cause either a cystic or solid tumor, and this may be either benign or malignant. Three cases of solid epithelial tumors, two of them benign and one malignant, have been reported having their origin from these sequestered cells. One case of cystic tumor having its origin from these cells occurred in my own practice, in a boy of ten. The right side of the lower jaw became quite rapidly expanded without pain of any kind or loosening of the teeth. On incision a cyst was found as large as an English walnut. Microscopically the wall was made up of epithelial cells, resting upon a fibrous base. The age of the patient, the rate of growth, the want of constitutional effects, the X-ray pictures, and if necessary an exploratory incision disclosing a cyst or other well circumscribed growth will serve to establish the benign character of these tumors.

Endotheliomata also occur in the maxillary bones, more especially in the alveolar processes. They take their origin either from the endothelial cells lining the lymphatic vessels or from the endothelial or perithelial cells of the bloodvessels.

The so-called angeio-sarcoma is nearly always an endothelial growth which has taken origin from the cells of the bloodvessels, the first act in its formation being the sprouting of the endothelial cells of the vessels and the formation of new capillaries. The endotheliomata of bones rich in bloodvessels are at times very malignant; as a rule, however, they have a low grade of malignancy, and except at a late period do not produce metastasis or other marked constitutional disturbances. They cannot clinically be

differentiated from the sarcomatous growths.

CARCINOMATOUS GROWTHS OF THE MAXILLARY BONES OR THEIR COVERINGS.

This genus is represented by three species. One of these is the epitheliomatous ulcer which may be seen upon the gums, and which has all of the characteristics of an epitheliomata in other situations. Primarily there may be an ulcer, a fissure, or a small wart. Ulceration, in any event, is soon established. The ulcer, if upon the inside of the gums, may spread to the tongue, tonsils, and soft palate; if upon the outside of the gums it is likely to spread to the cheek. It is usually circumscribed, often round, and has the hard, indurated, parchment-like base which is so characteristic of these ulcers in other situations. It occurs in persons advanced in years. The ulcer cannot be made to heal by any of the ordinary means, and sooner or later invades the adjacent tissues and produces enlargement of the nearest lymphatic glands. The only condition with which it is likely to be mistaken is a tubercular ulcer. This, however, has not the board-like induration of its base and borders, is not so progressive, and occurs usually in individuals giving other symptoms of tuberculosis.

The second species of carcinoma is the adeno-carcinoma. This occurs in the antrum of Highmore, from the glandular structure of the mucous membrane, and produces a soft, very vascular, at times rapidly growing and very malignant tumor. The growth may in a short time fill the antrum, causing pressure upon and later destroying its walls, after which it invades the surrounding structures, implicating the lymphatic glands adjacent and producing distant metastasis. With very few exceptions the process occurs after middle life, and more frequently after fifty years of age. The growth is attended with a good deal of pain and swelling. The swelling may be limited to one wall or implicate all of the walls of the antrum.

The diagnosis is made by taking into consideration the age of the patient, the comparative rapidity of the growth, the severe pain followed by destruction of the walls of the antrum, with regional and metastatic infection. An X-ray picture will disclose destruction of the walls of the antrum, and an exploratory incision will show a soft cellular growth filling the antrum and invading the adjacent structures.

The third species is the cystic or solid carcinomatous or epitheliomatous growth which occurs within the alveolar processes from the sequestered cells of the enamel organ. But very few of these cases have thus far been reported. These were small fleshy or cystic growths within the bone or pulp-cavity. They do not seem to have been very malignant. Their diagnosis would be difficult without a microscopic examination.

Discussion.

Dr. G. V. BLACK, Chicago, Ill. I have seen many varieties of these tumors, and the evil results of a failure to diagnose them early. Many of the malignant tumors, if diagnosed properly and promptly, may be operated upon with almost perfect safety to the patient, whereas if the diagnosis is faulty and the proper operation is deferred, death is the almost certain result. Now, there

are a number of things to be taken into consideration in the matter of diagnosis of tumors.

I remember one patient who came to me many years ago—nearly twenty—with a suspicious sore on the lip, and the case was operated on at once. The man was not long ago in this city, as well as anyone, yet the microscopic examination of that growth showed it to be true epithelioma.

In another case that I did not see so early I was called by his physician into the country to see a patient. He had not been to a dentist. He had a suspicious sore in his mouth. An operation had previously been performed, and the result was not satisfactory, and I was asked to see him. After making the examination, I was forced to tell him it was too late, that it was epithelioma and would eventually destroy his life. Not satisfied with my opinion they went to another surgeon, and he made the same prognosis—too late to do anything. Yet that patient bragged of his health, and apparently he was in good health.

So it is with these malignant tumors. In order to cope with them, we must be able to recognize them quickly, and to distinguish between the malignant and benign varieties. Malignant growths occur about the mouth oftener than in any other region of the body, and this the statistics will bear out. The irritation from the sharp edges of teeth and broken roots is one of the factors favoring the development of cancer in this region very much oftener than other causes elsewhere. The region next in importance in the number of such malignant cancers is probably the uterus, but the mouth claims the very much larger share of victims. Lupus, as we used to call it before we knew the true bacteriological origin, also comes in for a large share of victims.

Whether these patients go to a physician, to the general surgeon, or to the dentist, it is equally necessary that the person to whom they are shown should be able to at once make a correct diagnosis.

It is not many years since I saw a specimen, where a section including a number of teeth had been resected from the mandible in a case which I found was merely a chronic alveolar abscess with a fistula opening upon the face—a condition that might have been cured by a comparatively trifling operation. This again illustrates the necessity of differentiating benign tumors from those liable to destroy life.

Dr. C. H. Oakman, Detroit, Mich. I recall the case of a man who was sent to me. After having had several teeth removed by an advertising dentist he developed distressing symptoms, resulting in his coming to my office for relief. The appearance of the patient was cachectic to a marked degree, and I was much concerned, being quite sure it was a case of epithelioma. Before determining on operation I cut out a small piece of the tissue from the affected part and had it examined by a pathologist; the report confirmed my suspicion. Two weeks after the operation had been performed and the infected part placed in the best possible condition, the antrum was filled with a growth having a cauliflower appearance, and it was necessary to curette it every ten days to two weeks, a quantity of tissue being removed each time. This condition kept recurring, and at the end of four months the patient died in agony. The whole side of the face was involved, the eyes were closed, and the neck distended far beyond the line of the face.

Another case was that of tuberculosis of the jaw in a little child nine years of age. A swelling had been there several months and but very little attention was paid to it; finally the family dentist determined to extract a molar tooth which he thought might be causing the trouble; he was unable to do so. The patient was brought to me the next day. It did not appear to me that the molar was the primary cause of the disturbance. The child's temperature was 102° F., and remained so for several days. After watching the case for four days I decided to operate. The diagnosis of tuberculosis was made through the microscope. I extracted the tooth, made an external incision above the facial artery, and thoroughly curetted the region—removing considerable bone. The case progressed favorably, the temperature soon became normal and the child gained weight rapidly. I heard six weeks ago that she had had no trouble since and was attending school regularly.

Referring to the matter of obtaining a skiagraphic picture of the antrum, as mentioned in the paper, I have never seen that done but once, and that was in the case of an edentulous jaw, and an excellent definition of the antrum was obtained. Where the teeth are in the jaw it is almost impossible to get a good picture, and the gentleman who takes skiagraphs for me has never been able to do so. I hope some of the gentlemen here may have some typical pictures with them, so that I may be able to take some information home to my X-ray friends.

Dr. Vida A. Latham, Chicago, Ill. I would like to call attention to a danger that is common. I remember having had a case some two years ago of an elderly lady who had trouble with the mandible on the left side, about the neighborhood of the lower first molar. The case had been diagnosed as one of necrosis of the jaw. There was a fistulous opening. Before it came to me through her daughter, who was a physician, she had been urged to see a general surgeon, and he operated upon her. The surgeon could not exactly determine the nature of the trouble, so he cut into the jaw-bone, curetted and scraped it. I was present during the operation, they having sent for me by her instruction, and as he could not get the first molar out, he turned around to me, and said, "Can you get this tooth out; that is your job, not mine?" I declined to take the tooth out. He said it had to come out, and finally, after a few minutes succeeded in extracting that tooth and likewise the second molar, and then finished the curetting.

That case was operated upon at five different times, and, at the end the mandible was greatly reduced in thickness. That same patient developed later a pyonephritic abscess which finally burrowed into the abdomen and caused a considerable rise in temperature and great suffering. The case came back to me in this condition, and when I saw it I told the patient she had to undergo another operation. By that time she had a large opening under the mandible, so that the food and saliva would escape and run down her neck on her dress, a condition that was almost impossible to endure. I called in consultation Drs. Bertha E. Bush and John S. Marshall, who kindly consented to operate for the oral condition, and found instead of a necrotic bone or a malignant growth, an odontome embedded in the ascending ramus, which was removed at once, and today that patient is alive and well in California.

We must be exceedingly cautious about tumors of the jaw and their pathology. So far as I have gone into the subject, I would like to say that I know of no region of the body in which malignant or benign growths can take on so many different varieties of form. I have seen more than one tumor or neoplasm with the characteristics of four and even five different neoplasmatic varieties. What does that lead to? The surgeon will first find a small fibroid growth, and by taking a superficial cutting will discover on examination the fibers of a benign, not a malignant tumor, but if the deeper tissue be examined the characteristics of angeioma may be discovered, and if the still deeper tissue, those of a mixed form of sarcomatous carcinoma. The danger of overlooking malignancy is as great as Dr. Black has pointed out, and requires a most carefully selected section from the entire depth of a growth made in the operating room so that the surgeon and pathologist working together can verify the diagnosis made at the time of operating.

I would say from a microscopical standpoint, be very cautious about accepting a diagnosis of a non-carcinomatous growth, as many cases not carcinomatous in the beginning will develop that characteristic later.

As I said in the beginning, we may talk about confusing sarcoma with inflamed tissue, but from the point of view of clinical and microscopic pathology, I would like to know how we can positively differentiate a neoplasm from inflamed tissue.

Dr. Thos. L. Gilmer, Chicago, Ill. We should teach dental students that one of the most important parts of their work is to thoroughly examine the entire field. Why? Because this is a part of the body which is most subject to malignant growths, and we know that the dentist is the one that will be most likely to see them in their incipiency, when by an operation the patient's life may be saved.

Let us bring the matter home to ourselves and remember what we have heard today and also that to simply examine teeth for cavities to fill is by no means the whole duty of the dentist.

What would you think of a rhinologist who would simply look for some one particular diseased condition, or an ophthalmoscopist who would examine only one particular part of the eye and let all else go? We must become dental surgeons in the broadest sense.

All this is the more important, because the statistics show us that 85 per cent. of all pathological growths in the mouth are malignant, many of which by early recognition and removal would save the patient's life.

Regarding the X ray. I think that is a help not sufficiently employed by the oral surgeon and dentist. In the case spoken of by Dr. Latham it was perhaps a little early for the X ray to be of assistance; but if we would utilize the X ray in order to determine the condition, fewer mistakes would be made in resecting the jaw for conditions not requiring it.

I will relate a case that came under my observation, which Dr. Arthur Black will remember. The patient had been suffering for a number of years with a great deal of pain at times in the region of the angle of the jaw, with an occasional swelling, and accompanied by a rise in temperature. There was no external appearance of trouble so far as could be observed. The pain was of neuralgic nature, diffused over that side

of the face. The case had been examined by surgeons and by dentists, and none were able to make a satisfactory diagnosis. The patient's health was running down and she was in despair. When the patient came into my hands I brought to my assistance the X ray, and what did I find? I found in the ascending ramus an impacted third molar. I removed the tooth with considerable difficulty and the patient recovered.

Dr. G. V. Black. I will give an incident as illustrative. I was called in consultation by Dr. Prince, many years ago, concerning a young patient whom he had had under observation a few weeks in the hospital. He said there was a sore in her mouth that refused to heal. I examined the patient and found some considerable thickening of the cheek and a suppurating surface. By holding the tissues in a certain way and by having the patient close the mouth I discovered that a third molar with very sharp cusps had recently come through on the buccal side, and at every closure of the mouth it would dig into that sore. By extracting the tooth Dr. Prince cured the case.

The Chairman. I have had some experience, and have met both good and bad fortune in these cases. I remember one patient some years ago in whose case we found the original etiological factor was an unerupted tooth. The history of the case was somewhat doubtful. I had sections made, but unfortunately the microscope will not always tell us what we want, because there is a stage—which was referred to by Dr. Levings—during which the microscope will very often in sarcoma show nothing that absolutely distinguishes it from other inflammatory conditions, so we are thrown back from the microscope upon just such little clinical points as he has given out today. That happened in this case, and in a few months I learned of the patient's death from a malignant growth, after a series of operations by different surgeons.

A year ago last July I was consulted by letter concerning a patient living at a distance, who had a sore on his lip that would not heal. It was not much of a sore, and the question was referred to me as a possible clinical case for the next winter. The condition as described to me in the letter was such that I wrote, that if I undertook anything relative to it I must see it immediately, for otherwise I could have nothing to do with it. The case did not come to me in the clinic, but when the winter term came on, in the course of a few months, it was in the hands of a general surgeon, and afterwards I was called upon to help out. The patient was in an absolutely hopeless state; his entire lower lip and anterior portion of the mandible had been removed, and what remained of the tissues on either side had been drawn together by great stretching to meet in the center, with the result there was almost no jaw left and the two remaining portions of jaw-bone (the rami) were loose and flapping. He was in a condition in which life was unendurable, and worse than he would have been without the operation.

I have seen many cases of that kind—beginning in a simple way, just as that case had done—and when operated upon finally they were horribly mutilated. It seems to me to be the worst kind of brutality to perform that kind of operation when there is no prospect of a hopeful permanent result.

Dr. J. D. Patterson, Kansas City, Mo. Some five months ago, the wife of a physician came to me with a swelling on the left side of the maxilla and a large cyst in the vault, which her physi-

cian had diagnosed as antrum trouble. I was not prepared to give any attention to the case, and the case was referred to an X-ray specialist. The X ray confirmed the diagnosis previously made by the physician as disease of the antrum. A surgeon advised that the sooner the maxilla was taken away the better for the patient. I examined the case and found all of the teeth in perfect condition save the lateral incisor, which was dark and had long been devitalized, having been the seat of disease before it had been filled some twelve years previous; but after that it had not given any great trouble, except for some swelling upon that side of the face. I looked for diagnostic signs of antrum trouble and did not find them. I advised her to have that tooth out before having an antrum operation, and I extracted the tooth. Upon extraction there came from the socket an enormous amount of pus. I opened into the cyst on the vault, and found the bone involved in the disease and all around the contiguous territory from the nose down to the vault of the palate filled with purulent matter. There was no disease of the antrum. In the examination I found no entrance to the antrum. The case was cured within two weeks after treatment.

In other cases I have been very much aided by the X-ray examination, but this experience has led me to be very cautious.

Dr. Levings. I would like to speak on one or two points. One of these is, that I appreciate the fact that this subject is clearly understood by the gentlemen composing this section and needs no elucidation. I do not think, however, that the differential diagnosis or the pathology—and I speak more especially of cases of chronic necrosis, their symptoms, and their course—is sufficiently understood by the general dentist, consequently he makes mistakes. We all make mistakes, but the general dentist makes more than he should. The objection is made that by the microscope you cannot differentiate one part of a tumor from a fibroid, another from myxoma, and another from carcinomatous growth. That may be true, and I doubt not it is true. Still I think the microscopist is not always the best clinical diagnostician. He sees only the dead specimens. If he is going to make a correct diagnosis, let it be upon the living tissue. He should have experience in foreseeing the course these cases will take, and not simply make an examination of the dead product. What we want is the living product at a time when one can be of benefit to his patient. No benefit comes to the patient by telling the friends, after he is dead, that he suffered from a fibroid or carcinomatous growth.

What we want is a diagnosis of the patient's condition based upon clinical symptoms. I believe if one considers the malignant processes intelligently, he will be able to differentiate them in nearly every case from chronic inflammatory processes. Now these malignant growths seldom, if ever, lead to pus formation, and if you have considerable pus formation you can almost always exclude malignancy. Cases of chronic periostitis and necrosis, and cases of benign growth one should exclude by the clinical symptoms. I think the principle should be, as I stated in the paper, that every growth should be considered possibly malignant until proved benign.

Operations to be of permanent benefit to the patient must remove all the growth. If then, on account of anatomical difficulties, all the growth cannot

be removed, there is no occasion to operate unless the operation might relieve pain, lessen suppuration, or be done for its cosmetic effect. Remove all the growth if you possibly can. I do not think the deformity with which the patient is left should be taken into account at all. If all the growth can be removed, the deformity may at the time or subsequently be corrected in some way. Of course it is not certain that all of the diseased structures can be removed, but if it is probable, then I think we should operate.

The subject was passed, and the section adjourned until 2.30 P.M. Friday.

SECTION V—Continued.

FOURTH DAY—Friday, September 2d.

The section was called to order by Dr. Geo. V. I. Brown, the chairman. Dr. José J. Rojo of Mexico presided as honorary chairman.

The first paper was read by Dr. W. J. Roe of Philadelphia, Pa., entitled: "Report of Five Cases of Ankylosis of the Temporo-Maxillary Articulation."

Report of Five Cases of Ankylosis of the Temporo-Maxillary Articulation.

By W. J. ROE, M.D., D.D.S., Philadelphia, Pa.,

CHIEF CLINICAL ASSISTANT IN CHARGE OF THE DEPARTMENT OF DISEASES OF THE MOUTH, JEFFERSON MEDICAL COLLEGE HOSPITAL; ASSISTANT DEMONSTRATOR OF ANATOMY AND SURGERY, JEFFERSON MEDICAL COLLEGE; PROFESSOR OF SURGICAL PATHOLOGY AND ORAL SURGERY, PENNSYLVANIA COLLEGE OF DENTAL SURGERY.

The present paper is supplementary to that which I read before the National Dental Association at its meeting at Niagara Falls, in 1902, entitled "Bilateral Bony Ankylosis of the Temporo-Maxillary Articulation of Traumatic Origin, and Its Surgical Treatment: with Report of Cases I and II."* Five further cases are here reported, viz:

Case III. *Unilateral bony ankylosis of traumatic origin.*

Case IV. *Bilateral bony ankylosis of traumatic origin.*

Case V. *Bilateral bony ankylosis of traumatic origin.*

Case VI. *Unilateral fibrous ankylosis following operation for carcinoma.* (With the surgical treatment of Cases III, IV, V, and VI.)

Case VII. *Unilateral fibrous ankylosis following typhoid fever complicated with noma.* (With suggestions upon the surgical treatment.)

* Published in the *Proceedings of the National Dental Association* for 1902; also in the *Dental Digest*, March 1903; *Annals of Surgery*, August 1903.

In this report I have avoided as far as possible a repetition of the points of interest discussed in my previous paper on the subject, and only allude to the questions that arise in connection with each case, in the hope of making it of more practical value to those who are especially interested in this work, and who can refer to my previous paper. Therefore, as a paper this report is necessarily incomplete.

Case III.

Unilateral bony ankolysis. E. T. of Pennsylvania, aged thirteen years, was kindly referred to me, December 3, 1903, by Dr. Edwin A. Heller of Philadelphia, Pa. He was a first child; the labor lasted three days, and terminated with a difficult forceps delivery. Certain peculiarities were not recognized until ankylosis was discovered. His mother by comparing his early condition with that of her subsequent three children, all of whom she nursed, recalls the following significant facts: He had difficulty, in nursing, in keeping the milk within his mouth and in swallowing. After dentition the nipple would frequently get caught between his teeth and was withdrawn with some difficulty, and not uncommonly injured, which finally resulted in a mammary abscess when he was one year old.

He had a severe abscess on the left side of the face when one and a-half years of age, was treated by Dr. Guy Hinsdale, who incised the abscess at three points—over the bridge of the nose; at the outer portion of the left orbital cavity; and one inch in front of and on a line with the external auditory meatus. At this time Dr. Hinsdale tried to examine his mouth and throat, but was unable to do so owing to the fixed position of the mandible, which was at that time thought to be due to the abscess, which healed in one month. He was four years of age when it was definitely discovered that he suffered from ankylosis.

The etiology in this case is of special importance, and it is fair to assume that the injury to the mandible and the articulation occurred at birth and was due to the strenuous use of the obstetrical forceps. The etiology is similar to a case reported by Langenbeck, who gave as the cause, "Injury done at birth by forceps, in which both joints were involved." At the sixth year of age he excised both joints with good results until death three years later from tuberculosis. It seems evident in this case that the marked degree of ankylosis preceded the abscess on the left side of the face, which, whether incidental or secondary to the ankylosis, in all probability helped to increase its intensity.

It is a remarkable fact that in most of these cases ankylosis is not discovered for months or years, even though positive symptoms pointing to that condition have been recognized, but without their significance being considered.

The physical condition of this patient presented many interesting features. The micrognathism (as shown in Fig. 1) is very marked. His facial measurements were as follows: From the hair line to the glabella was $1\frac{7}{8}$ inches; from the glabella to the point of junction of the nasal septum and the lip was $1\frac{7}{8}$ inches; from this latter point to the point of the chin was $2\frac{3}{4}$ inches, from the point of the chin to the line of harmony was $1\frac{3}{4}$ inches. Therefore, the point of the chin was $1\frac{3}{4}$ inches behind and $\frac{7}{8}$ of an inch below the place it should occupy. The median line of the mandible was

slightly deviated toward the left side. The oral cavity presented conditions unusual even for cases of ankylosis, as shown in Fig. 2, due largely to the relatively closer position of the mandible to the maxilla. Aside from the usual malocclusion, the crowns of the anterior twelve teeth were exposed, of the bicuspids about half exposed, and of the molars completely hidden. The buccogingival borders in the molar regions were in intimate contact but not united. He introduced his nutriment through the space between the upper and lower incisors, the cutting edges of which were about on the same horizontal plane.

He could move the mandible in a lateral direction from left to right about 3/10 cm., and although there was comparatively little vertical motion it was evidently greater upon the right than upon the left side. Upon the lateral motion and this varying degree of vertical motion, the diagnosis of left unilateral bony ankylosis was established. This skiagraph (Fig. 3), taken by Dr. W. F. Manges of the Jefferson Hospital, shows the size and position of the mandible and its articulations, and to some degree it assisted in confirming the diagnosis.

Fig. 1.

Fig. 2.

(*Case III.*)

Further examination in reference to prognosis and treatment elicited symptoms of paramount importance. Respiration was very greatly impeded and slight exertion caused dyspnea. His breathing was labored and noisy—in fact, ordinary respiration was noisy and required some voluntary effort. Since childhood his breathing when asleep was loudly ster-

torous. During the six months previous to the operation his parents noticed a marked increase of the respiratory difficulty; he was no longer able to sleep in a recumbent posture, but in a chair with his head leaning well forward. Several times during the latter three months his parent's attention was called to him during the night and they thought he would strangle.

Fig. 3.

(*Case III.*)

Having kept him under observation for almost three months, and as there was no improvement, but on the contrary a noticeable increase in the respiratory

difficulty, upon the earnest solicitations of the patient and his parents I decided to operate.

The choice of the anesthetic in this case troubled me greatly, and I decided to use a local anesthetic. I preferred eucain owing to its comparatively low toxic qualities, fearing the complications which I thought would inevitably result should he be given ether. The vivid recollection of having been compelled to do a quick laryngotomy for respiratory obstruction about the close of my second operation upon my second case—whose condition, although similar in many respects, was not so pronounced—was certainly not encouraging.

After his admission to the Jefferson Hospital, I had an opportunity to study the respiratory phenomena during sleep in a recumbent posture. He would have a full, deep, and loud stertorous inspiration followed by three or four abortive inspirations, during which times the sides of his chest would be forced in and quite marked cyanosis would develop, when a general contortion or convulsive movement would take place accompanied by a greater degree of cyanosis, and followed by relaxation, when the full and long inspiration would occur to which I have already alluded. There was a continued repetition of the above phenomena and the patient would move all over the bed and assume many different attitudes. This demonstration further convinced me that a general anesthetic would be a perilous undertaking, and yet I feared the success of a local agent when I had so much bone to remove and in that particular location.

Operation, February 23, 1904. The soft tissues in the region of the left articulation were carefully infiltrated with 20 minims of a 2 per cent. solution of beta-eucain, during which the patient had symptoms of syncope from which he soon reacted. The operation of subperiosteal excision of the callus including the head and neck of the condyle, as described in my previous paper, was carried out rapidly and successfully. The patient conversed and several times sang short nursery rhymes, and only occasionally gave slight evidence of pain and required to be restrained. As soon as the section was completed the mandible dropped and he immediately opened his mouth three-quarters of an inch, and was delighted. His pulse improved during the operation, and after applying the dressing I counted it, and found it was 82 per minute, full and regular. He remained in the operating room for fully twenty minutes after the operation was completed, and as he was considered to be in good condition I allowed him to be taken to his room under the care of Dr. Thos. C. Stellwagen, Jr., who had assisted me. When he reached his room he conversed with his mother and showed her how far he could open his mouth, and afterward drank some water. Dr. Stellwagen after remaining fifteen minutes left him, believing that he was doing well and being assured by his mother that he was breathing as well as before the operation. Ten minutes later, while in the care of two nurses, he became cyanotic and struggled from their grasp, stood up in bed and fell back unconscious, with complete respiratory arrest. The resident surgeon saw him immediately and instituted artificial respiration, also traction upon the tongue and mandible. About two minutes later I saw him, and although he still had a feeble pulse he did not respond to our further efforts. His death was certainly due to failure of respiration, as his pulse

did not begin to fail until extreme cyanosis developed, but it was quite impossible to ascertain definitely the cause of the obstruction.

I have been criticized for not remaining with my patient, and I deeply regret not being present, but had not the least intimation or thought of such an occurrence at that time. Had I had the opportunity to do a laryngotomy or tracheotomy, it is possible he could have been restored.

The prognosis of this case was decidedly unfavorable. Had an attempt to relieve him been withheld he would have probably strangled to death in the near future, as any incidental inflammatory affection of the upper respiratory tract would have been extremely dangerous and practically beyond control. The danger incident to the surgical treatment is in proportion to the amount of respiratory difficulty, and this is largely dependent upon the time at which ankylosis occurs. This point is discussed in my previous paper.

The fact that simple fixation of an articulation will not produce ankylosis is very clearly and forcefully demonstrated in this case. Although the right temporo-maxillary articulation had lain practically immobilized during the entire life of the patient, it was readily movable as soon as the opposite articulation was made free. Had he survived, it is my firm conviction that practically normal function of the right articulation would soon have been re-established.

In a similar case, I am at present undecided as to whether I would advise a preliminary tracheotomy, or proceed along the same lines. Although there was no evidence of toxic symptoms from the use of the eucain, I believe that the greatest care should be exercised in avoiding every possible agent that might weaken the patient. In a similar case I would at first employ a weaker solution, using later a stronger solution if I found it absolutely necessary.

One significant fact has been impressed upon me in each and every case: these patients have comparatively little strength or recuperative power when compared with our general surgical cases, and I believe that the explanation of this lies in the fact that their nourishment has been limited practically to liquid foods.

Case IV.

Bilateral bony ankylosis. E. McD. of Pennsylvania, aged thirteen years, kindly referred by Dr. Justin G. Schwerin of Philadelphia, Pa. When eight and one-half years of age he fell from the roof of a box-car, striking his face on the cinder bed. He was taken to St. Mary's Hospital, where the resident physician, after examining him and suturing a severe lacerated wound of the lower lip and one of the chin, said that the mandible was fractured. He was discharged from the hospital on the following day and returned to the dispensary for further treatment. The wounds were healed in one week and no further notice seems to have been taken of the fractured mandible. About four months later he entered St. John's Home, and it was then discovered that he had ankylosis.

He was given ether on two occasions at one of our hospitals, and the surgeon used wedges and mouth-gags, and subsequently strenuous efforts were made to maintain what was gained in this way, but without success.

His condition previous to operation is illustrated in Figs. 4, 5, and 6. His facial

measurements were as follows: From the hair line to the glabella, 2 inches; from the glabella to the junction of the nasal septum and lip, 2 inches; and from the latter point to the point of the chin, 2¾ inches. From the lower border of the zygoma to the angle of the mandible on each side, 2 inches, and from either angle to the symphysis menti, 3⅛ inches. The lower border of the cricoid cartilage is 1¼ inches above the upper border of the manubrium. There is a transverse cicatrix over the point of the chin 1½ inches long, a second parallel with the lower lip and ¼ of an inch beneath its free border, which is 1¾ inches in length. The upper right lateral incisor is displaced outward, due to his forcing food into the mouth through that space. He can voluntarily separate the anterior teeth 3/10 cm., as shown in Fig. 6. Two excellent skiagraphs which were taken by Dr. W. F. Manges of the Jefferson Hospital showed the mass of bone uniting the ramus to the zygoma, and the position of the mandible. There was no special evidence of any respiratory difficulty.

Operation, June 28, 1904. Ether was administered by Dr. William P. Hearn, and a subperiosteal excision of the right condyle and bone successfully performed. On July 5, 1904, the left side was similarly treated, and in neither instance was there any special difficulty or dangerous symptoms encountered.

In this case I withheld the use of the mouth-gag at the time of operation, depending upon the subsequent use of it. He was able to open his mouth without any stretching fully three-quarters of an inch. After two weeks I began the use of the gag, but owing to the pain caused by even very gentle pressure upon the teeth I was unable to use it to any advantage. Since then he has been etherized three times and moderate force has been used to stretch the tissue, with the result that he can voluntarily separate the anterior teeth 1¼ inches. He is able to masticate solid food and can exert very considerable force, but has no lateral motion.

A very gratifying result in this case was the entire absence of any paralysis of the muscles supplied by the malar and infra-orbital branches of the temporo-facial division of the seventh nerve. In my first two cases temporary paralysis of these muscles occurred, from which both completely recovered in the course of two months.

Fig. 4.

(*Case IV.*)

Case V.

Bilateral bony ankylosis. J. W. McC. of Alabama, aged nineteen

years. In association with Dr. M. I. Schamberg: we conferred and operated upon this case together. When four years of age, while sliding down a baluster the patient fell, striking his face and chin upon the floor. He bled profusely from mouth, nose, and ears, and subsequently some degree of fixation of the mandible was noticed; but it was not definitely discovered until three years after the accident, at which time he was examined by a dentist, that true ankylosis was present.

When ten years of age he was operated upon by a leading surgeon of Nashville, Tenn. Although I cannot say definitely what the nature of the operation was, I judge that it was a bilateral osteotomy. When in the hospital he was able to get a ripe grape in his mouth without breaking it. Soon afterward ankylosis gradually returned and was almost complete within three years.

When fourteen years of age he was treated by an osteopath in Atlanta for five months, with some improvement, being able to introduce two fingers between his anterior teeth; but again firm fixation of the mandible occurred.

I first saw him on August 2, 1904, and there was only a perceptible degree of movement, probably not more than 1/50 of an inch. (See Fig. 9.) There was marked micrognathism associated with considerable fulness immediately below the mandible, as shown in Figs. 7 and 8. His facial measurements were as follows: From the hair line to the glabella, 2½ inches; from the glabella to the junction of the nasal septum and the lip, 2½ inches;

FIG. 5.

(*Case IV.*) The occlusion.

FIG. 6.

Extent of separation.

from the lateral point to the point of the chin, 3 inches. The upper border of the cricoid cartilage is $2\frac{1}{2}$ inches above the manubrium. The median line of the mandible is about opposite to the median line of the face. The point of the chin is 4 inches from each point which corresponds to the site of the temporo-maxillary articulation, and 2 inches posterior to the line of harmony. There is no respiratory difficulty and he has only occasionally stertorous respiration during sleep.

Operation, August 16, 1904, at St. Joseph's Hospital; ether was administered by Dr. William P. Hearn. We performed an excision of the bone in the region of the right articulation without experiencing any special difficulty. In this case we both tried the use of the surgical dental engine which Dr. Schamberg kindly provided, and although we did quite satisfactory work with it, we decided we could accomplish as much if not more by the use of the chisel.

On August 24, 1904, we did the same operation upon the left side, and when the section was complete the mandible dropped about half an inch. When the patient was partially recovered from the ether I used the mouth-gag to stretch open the mouth more widely, and was able to separate the anterior teeth quite readily $1\frac{1}{2}$ inches, and could move the mandible laterally to a considerable extent.

I last saw him two days after the operation, when he was sitting up and convalescing most satisfactorily. We are quite confident that he will have not less than $1\frac{1}{4}$ inches of free voluntary movement. Dr. Schamberg will institute active and careful measures to bring the mandible forward, correct the malocclusion of the teeth, and possibly spread the arch, and I hope will at a future time be able to make a most satisfactory report of the results.

Case VI.

Unilateral fibrous ankylosis following operation for carcinoma. N. B. of Texas, aged forty-eight years, referred by Dr. Irwin of El Paso, Texas, and under the

Fig. 7.

(*Case V.*)

care of Prof. J. Chalmers DaCosta and the writer. Two months previous to his admission to Jefferson Hospital, November 17, 1903, he first detected a small growth upon the buccal mucous membrane on the right side, about opposite the lower third molar. The growth rapidly developed, and upon admission it extended anteriorly as far as the angle of the mouth and involved all of the

buccal mucous membrane and the alveolar process of the mandible and of the maxilla in the molar regions. It also had extended through the skin about the center of the cheek, and practically involved all of the soft tissue on the side of the face. A section of the tissue was examined histologically and proved to be a squamous-celled epithelioma. On November 28, 1903, we attempted the removal of the involved tissue, and after making an incision and exposing the interior of the mouth, we found it extended posteriorly and involved the tissues in the region of the tonsils. Considering the case inoperable we closed the wound, and eleven days later we excised the external carotid and a portion of its branches, and a week later did a similar operation upon the left external carotid, doing a modified Dawbarn operation for the starvation of malignant growths.

Three days later, the right side of his face was exposed to radium-bromid of a radio-activity of 900,000 for twenty minutes, and this was repeated daily for eleven days, increasing the period of exposure to forty minutes, after which exposure to the X rays was begun and was alternated with the radium treatment. There was a gradual shrinkage and decrease of the malignant tissue, and on April 21, 1904, we gave him ether and removed, with scissors and curette, portions of malignant tissue which remained.

FIG. 8.

(*Case V.*)

FIG. 9.

The occlusion.

As the case progressed a considerable degree of ankylosis resulted from the contraction of the cicatricial tissue which remained, and the mandible became ab-

solutely fixed, with almost no space through which to take nourishment.

On June 28, 1904, we gave him ether and I removed a section of the mandible one inch in length from the middle portion of the right half of the body, immediately in front of the cicatricial tissue, doing the method known as Esmarch's operation. The result has been most satisfactory, and at present he has free range of motion of more than one inch (see Figs. 10 and 11)—obtained without any subsequent stretching or active manipulation. This operation is certainly the one of choice, especially in unilateral fibrous ankylosis of severe type. It affords a decisive and permanent relief, which to the patient severely afflicted is an important consideration. Patients with less severe lesions and in practically normal health can withstand more prolonged and less radical means for their relief.

Fig. 10.

(*Case VI.*) The occlusion after operation.

Fig. 11.

Extent of separation after operation.

Case VII.

Unilateral fibrous ankylosis following typhoid fever complicated with noma: with suggestions upon the surgical treatment. Mrs. C. A. of Pennsylvania, aged nineteen years, was kindly referred by Drs. L. H. Bernd and Joseph Fabiana of Philadelphia. In September 1901 she was admitted to the Pennsylvania Hospital suffering with typhoid fever, which later was complicated with gangrenous stomatitis of the left buccal mucous membrane. While very ill and delirious she was etherized and the gangrenous

tissue removed with a sharp curette. As healing progressed, some degree of fixation of the mandible was noticed, and when at the expiration of two months she left the hospital, a marked degree of ankylosis with evidence of a localized necrosis of the maxilla was present. She returned in fifteen days, was etherized, the necrosed bone was removed, and the cavity curetted and packed.

Fig. 12.

(*Case VII.*) The occlusion.

Fig. 13.

Extent of separation.

The mouth-gag was then used to stretch and overcome the resistance of the contracted scar tissue. She was then able to open her mouth about three-quarters of an inch, and for the following month the mouth-gag was used daily, and was then discontinued as the fixation had recurred. She again entered the hospital, in April 1902, and was operated upon and careful subsequent treatment instituted, with the result that the ankylosis recurred.

Her present condition is shown in Figs. 12 and 13. She can separate the anterior teeth 4/10 cm. and can move the mandible in a lateral and antero-posterior direction to about the same extent. The first and second bicuspids and first molar are absent from the left side, and the second bicuspid, first and second molars from the right half of the mandible. All of the molars in the maxilla had been extracted at the time of the second operation. There is a dense band of fibrous tissue upon the left side connecting the mandible to the maxilla which is about three-quarters of an inch wide and probably one-half of an inch thick, attached above to the alveolar process in the molar region, and below to

the alveolar process in the region of the second and third molars.

The surgical treatment of these cases has been quite unsatisfactory in many instances. To incise the scar tissue is practically useless, as it rapidly unites. To attempt to force the mouth open by means of a gag would, if successful, probably cause a separation of the band of tissue at its attachments to the alveolar process or bone, carrying with it a portion of the bone. This also would soon reunite and prove entirely useless.

Dr. J. Ewing Mears, in the *Transactions* of the College of Physicians of Philadelphia, vol. ix, 1887, reported very satisfactory results in a case in which both buccal cavities were obliterated by cicatricial tissue, and in which the method by incision and excision of the scar tissue had resulted in three failures. His success was the result of a rather unique method which he instituted. In order to prevent the reunion of the scar tissue he caused mucous membrane to form over the ends of the severed tissue by passing a stout silk ligature around the band of tissue, and by gradually tightening it, causing it to cut through, and as it did so the mucous membrane formed over the new surface.

Operation upon this patient is being deferred for the present because she is nursing her second child. Upon my return I expect to operate, thoroughly excising this band of tissue with its attachments to the periosteum, preserving the mucous membrane and closing the wound entirely except for a small drainage opening. Although I have never operated upon a case of this kind, I am quite confident of good results, provided I get rapid healing of the wound.

Discussion.

Dr. J. S. Marshall, San Francisco, Cal. The only question in my mind is whether the patient may not have recurring ankylosis. I do not remember now how long it was since the first operation was done.

Dr. Roe. The first operation was performed in December 1901, the second in February 1902.

Dr. Marshall. When did you see the first case the last time?

Dr. Roe. I heard from the first case —the patient lived in New York—and when shown at Niagara Falls, the power to separate the jaws had increased.

The second patient lives in Philadelphia. I saw him within two weeks. He can at this time open his mouth an inch and a quarter, and has good masticating power.

Dr. Marshall. That is an exceedingly gratifying result. In almost all of these cases the trouble has been in the danger of the ankylosis recurring.

Dr. B. G. Maercklein, Milwaukee, Wis. I would like to ask Dr. Roe how much of the bone was removed—just the head of the condyle, or farther down on the neck? Possibly that might have some bearing upon the results.

Dr. Roe. I would like to answer this. I make it a rule in all these cases to make a continuous chiseling through from the zygoma to the region of the condyloid fossa. I chisel away until I can pass my index finger clear, not having it impinge between the occluding surfaces; but until I can pass my finger so that it does not touch either the upper part of the ramus or the lower part of the zygoma, and not until I can pass my finger without any pressure, do I feel satisfied that I have a sufficient opening.

Dr. T. L. Gilmer, Chicago, Ill. You are also careful to remove all the periosteum?

Dr. Roe. I do not remove the periosteum; I operate from the sub-periosteal side.

Dr. Marshall. How long do you keep the packing in the wound? How long did you use the packing in this case?

Dr. Roe. The technique is explained in my previous paper. I close the mouth absolutely, bringing the force of the masseter muscle to close the fissure; I close the skin with a cuticular suture, allowing no packing, getting primary union with the least amount of cicatrical tissue, and allow the blood-clot to form. I rather wish to have a considerable degree of blood-clot to flow in there in order to keep the parts separated.

Dr. Marshall. Have any cases suppurated after the operation?

Dr. Roe. No; I have been extremely careful not to have any sort of infection.

Dr. Maercklein. I desire to speak only in connection with the last case referred to by the essayist. It is somewhat unfinished; and I mention this only because I have recently had a similar case with very unsatisfactory results. A little girl about four and one-half years of age was afflicted with diphtheria last February. The family physician took care of the child, and there seems to have been an infection which spread to the mucous membrane of the alveolar border on the left side of the mouth on both the upper and lower jaws. A sloughing of tissue took place with exfoliation of, I believe, the upper molars and the lower second temporary molar. The child was very sick, of course, from the diphtheritic infection, but eventually recovered.

Shortly afterward the fibrous connective tissue and cicatricial tissue was formed about the mandible, uniting it with the upper jaw to such an extent that only slight motion was possible. The patient, having a relative a physician living in Milwaukee, came to the city, and Dr. Kreutzer, the relative, separated the cicatricial band, with apparent immediate relief, some time last May. As the essayist has described in his paper, the bone soon reunited, and I was called in consultation about three months afterward. The jaws had become rigidly fixed, no motion being obtainable except a slight lateral one. To the touch the band seemed to be of almost osseous density, and the upper and lower jaws appeared to be perfectly united. After administering an anesthetic, I operated, and dissected out all of this material, first dividing it in order to be able to open the mouth. After the division it was easily opened, and I could readily dissect out this hard, fibrous tissue—to such an extent that I exposed extensively the parotid gland in removing the cicatricial tissue. The healing process seemed to progress satisfactorily. We saved all the mucous membrane we possibly could, but there was a large exposure of denuded surface.

Despite all those efforts, on account of this denuding of the bones a number of points formed on the posterior edge, possibly in line with the internal pterygoid muscle; they were also removed and dissected out. For a number of weeks the success of the operation seemed to be very apparent, and when I last saw the patient, about three weeks afterward, everything had healed. The motion of the jaw was from an inch and a quarter to an inch and a half, with a little tension applied between the front teeth.

Just before coming here, I received a telephone message from Dr. Kreutzer informing me that the same condition that we had before is again beginning to supervene—fibrous bands again re-forming—and that the motion of the jaws is almost eliminated, there being less than half an inch of separation now.

I desire to report this case in connection with Dr. Roe's paper on account of the bad result ensuing, and I would be very much pleased to hear from Dr. Roe at any time in the future, and to receive any information or suggestions that anyone might possibly give in order to obviate this condition or again cure this possible secondary condition.

Dr. Roe (closing the discussion). I wish to thank the members for the interest they have taken in the paper and for their kind expressions. I have replied to the inquiries as the discussion progressed, and I shall take pleasure in communicating with Dr. Maercklein in reference to the conditions I find after I operate upon this case.

I am not undertaking this case with the same assurance that I would undertake a case of bony ankylosis. It may seem somewhat simple at the present consideration, but I fear the result much more—that is, the functional result—than I would if it were a case of bony ankylosis. I do not fear the incidental dangers consequent upon the operation in a case of fibrous ankylosis. In the last case there is a normal development of the mandible, for the woman was sixteen years old when this ankylosis occurred and there is no respiratory difficulty nor any abnormal relation of the organs which take part in the respiratory function, and should any difficulty occur during the administration of the anesthetic it would be a moment's work to cut through the fibrous tisue, bring the tongue forward, and do anything ordinarily done in respiratory difficulties under an anesthetic. But, I am not confident of the result unless I can preserve enough of the mucous membrane to close over the raw surface, and I intend to make a pressure from within and without and hold that mucous membrane in close contact with the denuded cheek surface, in order to get primary union or early union between the two surfaces and obtain the least amount of cicatricial tissue. If I can do that I feel that I shall get fairly good results, but I shall have some contraction from the inevitable formation of cicatricial tissue.

The Chairman. The next paper upon the program is a paper by Hofzahnarzt W. Pfaff of Dresden, Germany, "Stenosis of the Nasal Cavity Caused by Contraction of the Palate and Abnormal Position of the Teeth," which will be read in English by Dr. G. B. Maercklein of Milwaukee, Wis.

Dr. Maercklein read as follows:

Stenosis of the Nasal Cavity Caused by Contraction of the Palate and Abnormal Position of the Teeth: Treatment by Expansion of the Maxilla.

By Hofzahnarzt W. PFAFF, Dresden, Germany.

The present paper embraces a consideration of the latest researches of Zahnartz Gustav Schroeder of Cassel, Germany, involving the examination of over 2000 skulls, as well as 200 school children who were mentally deficient, 120 inmates of reformatories, and 1000 convicts.

In the year 1886 Dr. Eyesell delivered, at the Society of Natural Philosophy of Berlin, a lecture on "The Contraction of the Nasal Cavity Caused by the Contraction of the Palate and Abnormal Position of the Teeth." In the discussion which ensued, the possibility of treating the contraction of the nares through the expansion of the maxilla was considered doubtful, and all further experiments were dispensed with. In the year 1891 Prof. Sauer of Berlin tried to prove by two well-known cases that contraction of the nares could be remedied by means of rubber wedges of different sizes placed within the affected nasal cavity, thus straightening the crooked septum. It is not known how successful this treatment proved to be.

The anatomy of the nose and the bony structure of the skull is known, I believe, to everybody here, therefore I will at once begin with the subject of my paper —a cure for stenosis of the nares.

As the roof of the mouth forms the floor of the nasal cavity, it follows that a compression of the vault of the palate causes a contraction of the nasal cavity, thereby resulting in the approximation of the turbinated bones toward the septum of the nose.

The contractions may be: (1) Total, that is to say, when the nasal cavity and at the same time the hard palate are compressed on both sides from the anterior spine to the posterior spine, only touching the front or the back part of the nose. (2) Confined to one side (asymmetrical narrowing). In almost all cases the palatal contraction is accompanied by abnormal position of the teeth.

When inhaling through the nose, an olfactory sensation is the result. The current of air comes in contact with the olfactory nerve endings and mucous membrane of the turbinated bones. The course of the inhaled air is not along the floor of the nose, but directly along the anterior part of the nostril in a curved direction to the middle and upper turbinated bones, and then under the sphenoidal cells to the posterior extremity of the lower turbinated bones. In exhalation the course is exactly the reverse.

If the inspired air were to follow a direction along the floor of the nose and not come in contact with the olfactory nerves the sense of smell would be lost, even in the presence of the healthy olfac-

tory apparatus. Furthermore, the nostrils warm, clean, and moisten the inhaled air. Nasal breathing is of the greatest importance to the circulation at the base of the skull. Every inhalation empties the ethmoidal veins, the longitudinal sinus, and the cavernous plexus. When the nose becomes closed, the work ceases and venous hyperemia of the meninges results. The consequences are manifested in different cerebral diseases. Should nasal breathing be interrupted or made impossible mouth-breathing results. Through insufficiency of moisture, drying of the nasal cavity is brought about. Infectious germs are inhaled directly into the throat. Inflammation of the mucous membrane, as well as severe infectious diseases, are the consequence. Through a defective sense of smell vitiated air is not perceived, and goes directly through the mouth into the lungs. Diseases of the larynx, trachea, and lungs are too frequently the outcome of such breathing to require more than passing reference. Through defective oxidation of the blood, anemia is brought about. Disturbed sleep and night cough are always concomitant with mouth-breathing. Bilious attacks, nervous disturbances, arrested mental development, and deafness are likewise symptoms of mouth-breathing.

With contraction of the nasal passages respiration is not normal. The accumulated secretion in the nose, caused by disintegration and irritation of the respiratory and digestive apparatus cannot be removed.

INVESTIGATIONS INTO THE ETIOLOGY.

At the present time careful investigations are being carried on concerning the cause of high palate with abnormal position of the teeth and contraction of the nares. In the year 1843 Robert of Paris gave as the cause hypertrophy of the tonsils. Gronbeck believes that mouth-breathing causes a weak development of the nasal septum, and consequently a high palate. Among other causes may be mentioned: rhachitis, hereditary high palate, tumors in the nasal cavity or impinging upon it, thumb-sucking and abnormal position of the teeth in the maxilla, supernumerary teeth in the maxilla and mandible, a high atmospheric pressure in the cavity of the mouth, insufficient pressure in the nasal cavity, cheek and lip pressure, the displacing of the temporo-maxillary articulation, and disorders of nutrition during the developmental period of the mandible.

The latest investigations in this field were made in Switzerland by Dr. Buser. He measured and studied the mouth and nasal passages of 514 adults with well-formed teeth. In opposition to the works and researches of E. Block, Koerner, etc., who hold that mouth-breathing is caused by adenoid growths and is a cause of high palates as well as of irregularities of the teeth and malformations of the jaws, Buser states that the leptoprosopic face shows a high and narrow palatal vault and a high, narrow nasal cavity. In this form, as the teeth of the second dentition find scarcely room for development, dental irregularities and V-shaped arches result. The chamaprosopic form of face is indicative of wide nostrils, in harmony with a wide palatal vault.

Difficult breathing causes hypertrophy of the tonsils and swelling of the mucous membrane. The narrow respiratory passages of the leptoprosope are often displaced, while the same condition exercises no influence in the presence of nor-

mal nasal breathing as exhibited in the chamaprosope.

Therefore we find mouth-breathing as a consequence of adenoid vegetation in the leptoprosope oftener than in the chamaprosope. The anatomical conditions present in such cases contradict the possibility of any influence of the relaxed muscles of the cheek on the maxilla or on the shape of the face, by inspiration through the mouth.

The examinations and researches of Schroeder began five years ago and, as yet unfinished, embrace the examinations of 200 school children mentally deficient, 120 inmates of reformatories, over 1000 convicts, and 2000 skulls of the museums of Berlin, Vienna and Frankfurt. His investigations and results will be published in the near future in a separate communication, properly illustrated.

In most cases of irregularities of the deciduous teeth, as well as of the permanent ones, a deviation of the nasal septum is to be expected. The greater the pressure of the septum against the turbinated bones the less air will be inhaled through the nasal passages at each inspiration. The narrowness of the nasal passages produced by polypi, abscesses, and growths in the nose will not be discussed in this paper; such diseases are within the field of the rhinologist.

In most cases the curvature of the nasal septum is in a direction opposite to the pressure. At the same time, on the side on which there is a narrowing of the nares a more or less strongly pronounced deafness exists, almost always detectable in persons with irregularities of the teeth, an observation which is in some respects of great importance.

Concerning concomitant disturbances in the eyes, I must refer my readers to the work of Dr. Danziger.

MODES OF TREATMENT.

To remedy a contraction of the nasal passages an operation is required for the removal of part of the turbinated bones or part of the septum. Now, if it is possible by expanding the maxilla to remove the pressure against the septum and at the same time to enlarge the base of the nares and depress the high palate, there is a probability that the septum may eventually become straight. The volume of inhaled air will be larger, the turbinated bones will recede from the septum, the circulation at the roof and base of the skull will improve by the regular nasal inspirations, the mental activity as well as the sense of smell will be restored.

The first experiments on the expansion of the jaw for the purpose of expanding the nares were made by Schroeder five years ago, after the expansion of the nares by Prof. Sauer by means of india-rubber wedges had not met with any appreciable success. The Coffin plate is absolutely to be rejected, although it is not altogether impossible to get some results from it. The only successful treatment consists in capping the teeth with bands (Heydenhaus) and to use a screw which can be put on or taken off as desired (Schroeder's system).

Schroeder speaks of two different orthopedic treatments: (1) In an existing contraction of the nares, slowly expand the maxilla until the breathing through the nose becomes normal. (2) As a result of stenosis of the nasal passages prognathism of the mandible results, in which case the maxilla is forced back to a point near the vertebra. The contraction of the nares is too great to allow the passage of an increased volume of air, especially in sudden exertions of

the body, and results in diseases of the respiratory organs. In these cases the maxilla must be brought forward at the time of the first dentition and expanded until the articulation beeomes normal. The eure will then be quite certain.

The expansion of the maxilla in eonnection with the regulation of teeth is not a new proeedure. In 1895 Dr. Goddard of San Franeiseo published a case in whieh the symphysis had expanded one-half ineh in three weeks. Sueh rapid expansion in the treatment of eontraetion of the nares would not be favorable to suceess; on the eontrary, it would offer many serious disadvantages. The expansion of the upper jaw as a eure for eontraetion of the nares differs essentially from expansion for the regulation of teeth in abnormal position. It is neeessary to be familiar with the anatomy of the part as well as with the diseases of the nose and palate before undertaking sueh treatment. It is important for the operator to understand fully the regulation of teeth. The apparatus for expansion is firmly fixed with eement and worn by the patient with no ineonvenience whatever.

The expansion must take plaee slowly, aeeording to Schroeder's system. The slower the expansion the more perfect will be the widening at the higher part of the vault, that is, at the base of the skull, a result whieh, aeeording to Schroeder's opinion, is of the greatest importance. An expansion too quiekly effeeted would, in all probability, eause a separation of the halves of the maxilla, as Dr. Goddard has described. The suceess of the treatment would be very questionable, for it may easily happen that after a rapid expansion the current of air entering the floor of the nose will not reaeh the upper turbinated bones. It is important to turn the expansion screw only far enough for the little patient to distinctly feel the pressure. After two or three days every uncomfortable feeling will disappear, and the treatment is continued in the same way.

Sehroeder speaks of a little patient who had undergone two operations for the removal of adenoids in the posterior nares. These operations were performed without any favorable effeet. Strange to say, the pressure of the apparatus was not felt on the palate or alveolar surfaees, but rather on the forehead near the root of the nose.

In four weeks' time this great contraetion of the nares had been suffieiently remedied to allow breathing through the nostrils; and the sense of smell, whieh had been entirely lost, was restored.

Sehroeder has devised for this purpose an apparatus with an interehangeable serew, operating upon one or both sides. It is to be plaeed in a little interehangeable sleeve fastened on the apparatus. Formerly the first small serew, firmly fastened to the apparatus, was after a short time unscrewed, taken out of the mouth and no longer used. Then a new apparatus provided with a longer serew was made and adjusted with eement.

Everyone who has had extensive experienee in the regulation of teeth knows how tedious and harmful sueh a treatment would be. Now with Sehroeder's sleeve screws the apparatus fastened in with eement will not be taken out of its position, but the serew will be screwed baek to its first place, whereupon it is removed and the next size serew properly adjusted.

The time of treatment depends naturally on the ease itself. The treatment of the eontraction of the nares may last

from three to twelve months. Naturally more time is required in those cases where deafness is present. The question is, Is deafness with abnormal compression of the jaws to be considered the result of compression of the Eustachian tubes, or is it caused by swellings or inflamed tissues? Schroeder thinks that by expanding the jaw the existing compression on the auditory tubes is removed, and the exterior current of air will have its natural effect on the ear. Further observations will be necessary to answer this important question.

It should be noted that the position of the tension screw must be changed according to the type of contraction under treatment. An accurate knowledge of the condition, which may be furnished by a rhinologist, is absolutely necessary.

CONCLUSION.

I am entirely in sympathy with my colleague Schroeder's views. I have performed a great number of expansions of the maxilla in treating cases of prognathism, and always succeeded in effecting nose breathing where it was impossible before. It is wonderful how rapidly the physical and mental development of such children progress after the operation.

The statement that children become nervous while under treatment cannot be substantiated. It is only a question of a few days of discomfort for the children. I always found that with the expansion of the maxilla there was a flattening or lowering of the palate, and even when the expansion was not very great it was sufficient to restore normal breathing.

Dr. T. W. Brophy, Chicago, Ill., then read a paper entitled "The Radical Cure of Congenital Cleft Palate." The paper was as follows:

The Radical Cure of Congenital Cleft Palate: with Exhibition of Patients.

By TRUMAN W. BROPHY, M.D., D.D.S., Chicago, Ill.

I desire to call your attention to a few cases, which I will briefly describe, and to exhibit a few of the patients upon whom I have operated for immediate closure of the hard palate in early infancy.

I am well aware that the methods which I pursue are not generally practiced and are not well understood. I hold it to be highly important that the operation upon the palate should be made before that upon the lip. It is a great mistake to commence at the oral opening and to partly close the only aperture through which a subsequent palate operation must be made. The surgeon needs all the space that can be secured, which is none too much in a young child. The lip operation is comparatively simple and trivial, and it can be performed at any time; but the palate operation is made much more difficult if the lip has been closed prior to the operation. In proof of this I bring before you several patients whose condition will, I think, convince you that my position and practice are correct.

The first patient I show you is one upon whom I operated when she was ten

days old. In this case we had double hare-lip and a wide cleft of both hard and soft palate. The palate was closed at one operation throughout its entire length. The tissues had assumed normal relation and form. The arch is sufficiently wide to serve every purpose and the occlusion of the teeth is fairly good. You will notice that the occlusion of the upper with the lower teeth is not quite normal, but by employing means well known to dental practice these teeth can be forced a little farther out, so as to properly occlude with the lower ones. The fissures of the lip extend into the nostrils. The intermaxillary bones and the center portion of the lip were rudimentary. The lip, therefore, was formed by utilizing the tissue lateral to the fissures. An improvement in its appearance is yet to be made by removing some of the integument and reflecting the mucous membrane upward, thus shortening the lip. This child is now thirteen years old.

The second patient I show you is a child six years old. I operated, closing the hard palate, when the child was six weeks old. I have here a cast of the parts as they were prior to the operation which I will pass around. It was by no means an ordinary case. The opening is unusually wide, with the amount of tissue present comparatively small. On examination of the patient you will see the palate is completely closed, the parts being in good apposition through the reduction of the arch. The opening through the lip gave good access to the parts and the operation of moving the parts together was for this reason performed with greater ease. This little child is a brother of the girl first exhibited.

It is interesting to note in this connection that of the children born to the parents of these two, four were deformed in this particular. The eldest one was normal, and no evidence of the deformity existed, even to the slightest degree. The second was afflicted with double hare-lip and cleft palate; the third with hare-lip; the fourth with double hare-lip and cleft palate; the fifth was normal; the sixth was afflicted with single hare-lip and cleft palate. The deformities in these children have confirmed my opinion that nearly all such cases have hereditary origin. In this instance the paternal grandfather and a brother of the mother were similarly afflicted.

In conclusion, I wish to say that the time is not far off when the teachings will be so changed as to advocate the early operation for the cure of cleft palate.

In my paper read at Paris in 1900 I made the statement, which was then correct, that I had not lost any infants following the operation of cleft palate, and yet when I returned home the second patient I operated on I lost. There are many factors entering into this operation, and anyone who has had experience realizes that one of the most important considerations in the management of these cases is to have the infants under your immediate care and supervision for a time before the operation is made. The food question following an operation is the most important one—as to what kind of food best agrees with the individual, the kind that will nourish the child, how much food to give it, and so on; you must in all cases adapt the food to the particular infant. Surgical shock always raises the temperature somewhat, at times up to 102 or 103 degrees, and I resort to bathing with alcohol and water, using the methods adapted to the case.

I have not attempted to explain in detail the cases exhibited; that is not part of my duty here today. I am here to see whether I can interest anyone to advise parents to adopt this method and to advise physicians to throw aside old-fashioned notions and the teachings of their masters, and accept the views of today.

Discussion.

Dr. José J. Rojo, City of Mexico, Mexico. I wish to ask Dr. Brophy to what cause he mostly attributes cleft palate, and whether heredity may be considered a factor in its etiology.

Dr. Brophy. The influence of heredity is applicable to this as well as to any other malformation. We know, for instance, that sometimes club-feet are transmitted. I had a patient a few years ago who had in addition to cleft palate, double hare-lip, protruding intermaxillary bones, umbilical hernia, curvature of the spine, two thumbs on each hand, six toes on each foot, and a number of other deformities too numerous to mention. Malnutrition may be a cause —and I am satisfied that it is. I will cite the case of a woman who during the second month of gestation suffering from appendicitis, was operated upon, with the result that life was nearly lost from the operation and the infection in the appendix. When the little one came it had a hare-lip and a cleft palate, and I am satisfied that it had resulted from malnutrition—a lack of the essentials to build up the forming child. I believe that most parents who are of the opinion that pre-natal impressions play an important part in the causation of these deformities are in error; because, if one examine any considerable number of these cases, it will be found that the supposed pre-natal impression is often received at such a late period in the fetal life that it could not cause any such deformity. I always ask the mothers if they know how to account for the deformity, and almost all of them say that at a certain time they sustained a very great shock or fright; but when one comes to ascertain at what period of gestation that shock or fright occurred, it will be found that it occurred at the seventh or eighth month. Now, we all know it is impossible for a fright or shock at that time to produce a deformity such as cleft palate or hare-lip. If shock or fright could produce such a deformity, it must occur in the formative stage of the development of the fetus, and while the tissues are yet ununited. The union of those parts occurs prior to the fifth month; after this period only a little suture which outlines the union of the premaxillary bones with the maxillary bones proper can be seen. This sets aside the argument often made that pre-natal impressions cause cleft palate. If pre-natal impressions are capable of producing these deformities, the impressions must occur prior to the fourth month.

The Chairman. I would like to speak, if possible, on both sides of the question, and I think I can make it very clear that there is yet much to be done in the matter of early operations before we can successfully prevent arrested development and have anything like equal development of the features afterward when palate fissures have been closed, as described, in early infancy. I shall also undertake to show the danger of the lip operation at too early an age, and illustrate the wisdom of deferring these

operations until an age when they can be done with some degree of deliberation, thus saving the unsightly scars that so commonly result. I have a few slides which will give you the idea. Dr. Brophy, having performed the operation for so long and so often, unquestionably gets results which no one else could get. He always speaks of it as if it were simply a matter of choice with the surgeon, as if anybody could do it if he chose, and I think a great deal of harm may result by reason of that, which would not occur in Dr. Brophy's hands, because less experienced persons will be led to attempt to do the work.

Dr. Vida A. Latham, Chicago, Ill. I would like to ask Dr. Brophy and Dr. Brown the indications for early operations and the contra-indications.

Dr. Brophy. If I could control the patients, I would operate always before the third month. A little girl, now about fourteen years of age, was here. I operated on her, as I remember, before she was ten days old. I think there is no objection to operating at that very early age provided everything is going well. I want to know that all the organs of the body are performing their functions normally. I want to keep the child under observation a week or two, that I may study its peculiarities; and I want to have the patient well prepared for that operation—I regard this as one of the most essential steps; then, at the age of three months or under, the operation should be made.

The question has been asked why the operation should be deferred later, until the subjects become stronger. It is a very well established fact that the nervous system of a young infant is not developed up to a point which would enable it to sustain the same shock that it would when a year old. I do not think there is any doubt about that, because all the modern physiologists have so asserted, and this view is in accord with my own experience. I think that answers the question. If the condition was such that it was necessary to go beyond the period of six months, then I would not transfix the bones, although I have done it as late as the eighth month. It seems to me that every week past the period of four months makes the danger greater of transfixing the bones, and the only cases I have had serious difficulty with have been those in which I attempted to operate on infants of over six months. Then the shock is always greater. The bones are more difficult to move, and in very young infants we find that almost half the bone constituent is organic matter and we can bring them together with greater ease.

Dr. Emma Eames Chase, St. Louis, Mo. How do you feed them?

Dr. Brophy. I have succeeded in getting the head nurse in the children's ward at the Presbyterian Hospital, where I do the greater part of my work, to write an article on the care and food of my patients, and that will soon appear. I look forward to the publication of that article with a great deal of interest. She knows more about the care of my patients than I do. The food is adapted to the wants of the child. We have what we call modified sterilized foods—all the different kinds of food we have in the hospital, and to answer the question it would be necessary to go over them all. I must state that the feeding of the infant is an art and a science that no surgeon can understand as well as the nurse of the child. I have a very profound admiration for those nurses. We could not live without them;

they are the noblest women in the world, and when we all go to the hereafter, we will find them there sitting in high places.

Dr. Vida A. Latham. What do you do if you have no nurses? There is danger after the operation that the patient may die from want of nourishment.

Dr. Brophy. Dropping the food into the mouth is a method we use a great deal, dropping into it a little at a time, and feeding carefully in that way.

The Chairman. These children, when they come to us, are at best degenerates. We have no certainty that they are complete in other respects and that they have not other deformities which do not show as do the palatal deformities but which may be of greater vital importance, involving some of the internal organs, and particularly the digestive tract. Therefore I like to have the infants under my control and observation for a while before I do very much in the way of surgical operative work upon them. In regard to the feeding, we find it varies very greatly and must be adjusted to the individual baby with great care and consideration. Where I can have the child under control, I prefer to put off the operation until such time as I am reasonably sure that the child is at its very best, and that can only be determined to a certainty by carefully observing the peculiarities of each child. The death rate of all operations upon infants is unquestionably high. Dr. Brophy has done so many operations and so often that he does them with much less shock to the child than other surgeons would. But I do not believe that infants stand an operation very well. The shock of the operation is great because the nervous system and digestive tract are not well developed. We know that infants are frequently unable to withstand the uncertainties of a new life and new environment after birth even without operation. The history of those conditions is that such children do not stand hemorrhage well. Of course in doing the work skilfully, as Dr. Brophy does it, there would be very much less hemorrhage than if done by other hands. The point I make in this discussion is that it is not the work for everybody to undertake, and moreover I believe good results can be accomplished without the dangers of operation in early infancy.

Dr. Brophy (closing the discussion). I feel very well pleased indeed with the work of this section. I desire to state to the chairman that it has been to me a very serious deprivation to have been obliged to spend my time in another section. Although I have enjoyed the work in my section very much, I must confess that I would have enjoyed this more, because it is along the line of my life-work. I would like to inform the chairman that in our section we have disposed of eighteen papers of high literary character and merit. I think when the published record appears, that Section IX will have the credit for more literature than any other section in this great congress. Two things occurred to me while Dr. Brown was speaking: one was the apathy which is manifested everywhere in the world in regard to palatal work. As an illustration of that statement I want to say there is a member from a foreign country in this congress who traveled over Europe and all over the Eastern states of this country to get an operation performed on his little boy, and all refused to operate. He happened to hear of me, and came to Chicago. In twelve days after he arrived there he was on his way home with the

cleft in his boy's palate closed. So, you see, they will not do it; surgeons will put it off; they defer it for some cause. Probably because operations are difficult and often fail of success. We do not have cutting out of sutures any more. We have a way to avoid that. The question of hemorrhage is a very serious one; and in the discussion of the paper that I presented in Paris in 1900 a most accomplished surgeon, a surgeon who is probably doing more surgery of the palate today in France than anyone else, Professor Sebilot, made the statement that the reason my patients did not die was because there was no hemorrhage. It is true there is no hemorrhage of any consequence, and why? Because we make no incisions in an operation on an infant—rarely make them; we do not even freshen a particle of the surface of the tissue at the early stages of the operation. We move the bones together—that is the first step; and the second step is to pass the needle. So all the hemorrhage that we get is that produced by the passage of the needle. Consequently the child does not sustain a loss of blood. After the sutures are all in position, and after the parts are about ready to come in contact, it is then that we freshen the edges; and so soon as we have them freshened we bring the parts together and we get immediate cessation of the slight capillary hemorrhage. If there should be a little flow of blood by the passage of the needles, a gauze wrung out of hot water—as hot as can be borne without excoriating the parts—is placed in contact with it and there is no more flow of blood. The question of hemorrhage has been reduced to a minimum, and so little hemorrhage do we have that we may say that practically we have no hemorrhage. We divide no vessels, and all the blood we get is that from the capillaries, an insignificant amount.

Dr. Brown complimented me just now by saying that the great number of cases I have had enable me to do this well and without shock; and when I speak of that it brings us back to the question of hemorrhage and the method of procedure, the condition of the patient before the operation and the care of the patient afterward. When we take all those conditions into consideration, as well as the technique of the procedure, which should be reduced to the simplest possible steps, then we can do the operation without much shock. I do not consider the closure of the hard palate of a child now very difficult; there is a great deal of detail about it, and I am surprised sometimes at some of the statements of my friends. I write to them, and send out pictures, and tell them everything I can think of bearing on the question, yet I find that some of them have sutured through the bones but did not pass the sutures above the horizontal plates of the palate.

Last year, while attending the Fourteenth International Medical Congress, in Madrid, Spain, I was invited by that most accomplished surgeon and professor, Dr. Kirmisson, who is at the head of the Trousseau Hospital of Paris, France, to operate in his hospital. He told me he would have the patient ready on my arrival in Paris. When I arrived at the hospital they had several patients, and I operated on one. I was honored with the presence of thirty-four of the most distinguished surgeons of Paris, to witness my operation. Professor Ehrman, whose name appears in the literature on this subject of hare-lip and cleft palate from his very early experience as a physician and surgeon, was one of my

audience. I feel very much encouraged in this work, while I have met with doubts and criticisms. One prominent man would say, "You are going to close up the nose and that would be worse than the cleft in the palate." Another would say, "It will never do to close up the palate of the child," and so on. But now fifteen years have passed and the work is increasing, and the eminent men throughout our own and foreign countries have been kind enough to me to take up this work and advocate it among their colleagues.

The CHAIRMAN. If there is no other business to come before the section, we will adjourn. Personally I feel very proud that we have an American who is being copied by people abroad. I feel proud that the people from abroad have been so courteous as to give so much attention to this section, and say such nice things to us; and I am very thankful to all of you. I trust that when these proceedings are published you will feel that your faithfulness has been fully rewarded. We have now completed our program, and if there are no other remarks upon this subject we will adjourn. The section of Oral Surgery is now adjourned *sine die.*

Fourth International Dental Congress.

SECTION VI.

SECTION VI:

Orthodontia.

Chairman—Dr. Edward H. Angle, St. Louis, Mo.
Secretary—Dr. Milton T. Watson, Detroit, Mich.

FIRST DAY—Monday, August 29th.

The section was called to order at 2.40 p.m. by the chairman, Dr. Edward H. Angle.

The first order of business was the reading of the Chairman's address by Dr. Edward H. Angle, as follows:

Chairman's Address.

In behalf of the science of orthodontia it is with much pleasure that I welcome you to the meetings of this section, and venture the fond hope that it may be replete with pleasant and profitable experiences, both social and scientific.

The great importance that orthodontia is rapidly assuming proves the wisdom of this congress in assigning to us a distinct section for this special and important branch of science. Well may we be proud of the rapid strides that orthodontia is making. Well may we be proud that we have such a grand opportunity to meet and work together for the upbuilding of a branch of science so extremely fascinating—a science with a future so full of promise for contributing to the health, beauty, and happiness of the human race. I believe we can with real truth proudly assert that no other branch of dental science is at the present time making such rapid progress.

As there are many papers to be presented at this meeting, time will not permit me to review the past history of orthodontia, but it cannot be amiss for me to venture some suggestions for its future.

It has long been my belief, as many of you know, that orthodontia is by right, and with boundary lines clearly defined, a science which should be taught and practiced as a specialty; and to this end I have given and shall continue to give my best energies.

It is a fact which must be admitted by most thoughtful men, that the require-

ments in the study and preparation for the practice of orthodontia are so exacting that it is not probable that anything like its best possibilities can ever be realized with our present methods of education, or by combining its practice with the general practice of dentistry.

It is true that the marvelous improvements in the treatment of cases of orthodontia in the past few years render certain operations far more easily accomplished than formerly, and yet the standard in requirements of treatment is now so much greater that the difficulties in attaining the ideal in treatment are correspondingly increased. Most of the work done a few years ago, and considered creditable then, seems now, when analyzed according to the standards of the new school of orthodontia, to be ridiculously crude and unscientific. So the statement made many years ago by Dr. Guilford still holds true, and, we believe, must always hold true—that "no matter to what degree of perfection the regulating appliances may be brought. the complications and great variety of cases will always make orthodontia the most difficult class of work that dentists are called upon to perform, and will necessitate a degree of skill and judgment to meet these requirements that few have the patience or ability to acquire."

So, it must be apparent to all thinking men that its greatest possibilities can only be realized along the lines of specialization, for since it came to be practiced by men who give their entire time and attention to it its attainments have been greater than in its entire previous history.

It is practically only since the last great International Dental Congress held in America that men began to adopt orthodontia as an exclusive specialty. Now their numbers are rapidly increasing, and in every instance that I know of their efforts are meeting with most gratifying results, and I cannot help venturing the prophecy, that by the time of the meeting of another International Dental Congress in America, orthodontia will be represented by competent, conscientious specialists in every prominent city in the world. I sometimes marvel that the great cities of Europe, where wealth, culture, refinement, and appreciation of the best are so great, still remain without specialists in orthodontia.

The specialization of orthodontia is but the natural unfolding of progress and knowledge, and is but the following of the same general law that led to the establishment of other well-known specialties in medicine. Yet it is a singular fact that the specialties of rhinology, ophthalmology, etc., were established in spite of keen opposition on the part of the general practitioners of medicine—the very persons, it would seem, who should have been first to encourage a closer study by those having aptitude and liking for these special branches. I do not consider that the specialization of orthodontia is meeting as strong opposition from the general practitioners of dentistry, yet I regret that there is opposition, and that, too, from those who it would seem should act with greater wisdom.

The specialization of orthodontia will in no wise debar the general practitioner from its practice any more than the general practitioner of medicine is debarred from the practice of diseases now truly belonging to the field of the specialist. But it remains an axiom, that whether practiced by the specialist or by the general practitioner, the suc-

cess will be in proportion to the knowledge and skill of the man. And I would repeat, that the specialization of orthodontia is but the natural—the inevitable, the irresistible.

In accordance with this belief, four years ago there was organized in this city for the advancement of the specialty and the specialization of orthodontia, the American Society of Orthodontists, with ten members. At the second annual meeting the number of members reached twenty-seven, and at the third, or last, meeting the membership was inereased to fifty-two, or an increase of over four hundred per cent. in the three years, and the good work that this society is doing on behalf of orthodontia I believe is felt throughout the world. As an evidence of this good work it is with much pride we invite you to examine the handsome collection of casts contributed by some of the members of this society, which are on exhibition in the next room. Among its members are representatives from Canada, New Zealand, England, Ireland, Austria, Sweden, Holland, and Mexico. All teachers and specialists of orthodontia are eligible to membership and are cordially invited to become co-workers with us.

It seems to me that this time should be especially important for the interchange of thought from men from different parts of the world, for the reason that there is still such wide variance of opinion on the subject of orthodontia, as all who keep in touch with the literature of the day are aware. There are doubtless some questions in orthodontia on which a uniformity of opinion is hardly to be expected. Men have always differed as to methods employed for accomplishing results, or, in other words, as to the "how"—the technique. Doubtless this is desirable. Were it not so, there would probably be no progress. But as to what shall be the diagnosis, what the aim in treatment, what the results when completed, are questions on which it would seem to me men ought to have uniform opinions. Thus, as to what it is most desirable to accomplish in each given case, both in the final positions of the teeth and in the art relations of the face, I believe that we can and should agree, at least in a very large percentage of the cases we are called upon to treat. There cannot be a half dozen different opinions as to what is required in a given case, and all be right. There can be but one correct opinion.

I believe that mutilation and the saerifice of teeth is either necessary or unnecessary—is either right or wrong. If mutilation, as claimed by many, is essential to the best results in occlusion and usefulness of the teeth, as well as for establishing the greatest beauty of the face, then there must be laws governing this that can be well defined and elearly comprehended, and every praetitioner should know them and be able to apply them. On the other hand, if mutilation is unnecessary in the establishment of the best results in oeclusion and art, then there must also be laws that govern this, also clearly definable, and all should know them that they may work intelligently toward the best application of these laws. There must be classified knowledge governing these points, for if there are no definable principles, then orthodontia is not a science—is not a profession, but is still in ehaos and empiricism.

I believe these questions are of such vital importance in the great work which we are called upon to do as orthodontists, now and in the future, that it be-

hooves us to settle them as rapidly as possible, always bearing in mind that science, which is only another name for truth, is for all and comes from all.

It affords me great pleasure to present to you the symposium of papers which are to be read before this section, and which, we trust, will represent the brightest and best of orthodontia today.

We are especially favored by having papers from honored contributors from across the seas. We feel highly gratified that we are to have papers from such well known and distinguished men of science as Dr. Schroeder of Greifswald, Germany; Dr. Pfaff of Dresden; Dr. Franz Zeliska of Vienna; Dr. John Grevers of Amsterdam, Holland; Dr. Francisque Martin of Lyons, France, and Dr. Rojo of Mexico City; also from our American friends, both in this country and abroad, who are so well known to us as to need no introduction here.

It is with great pleasure I welcome you all, and I urge upon you all to work most earnestly and sincerely to make this great meeting a milestone in the history of orthodontia.

The Chairman then called on Dr. Chas. A. Hawley, Columbus, O., to read his paper entitled "Determination of the Normal Arch, and its Application to Orthodontia," as follows:

Determination of the Normal Arch, and its Application to Orthodontia.

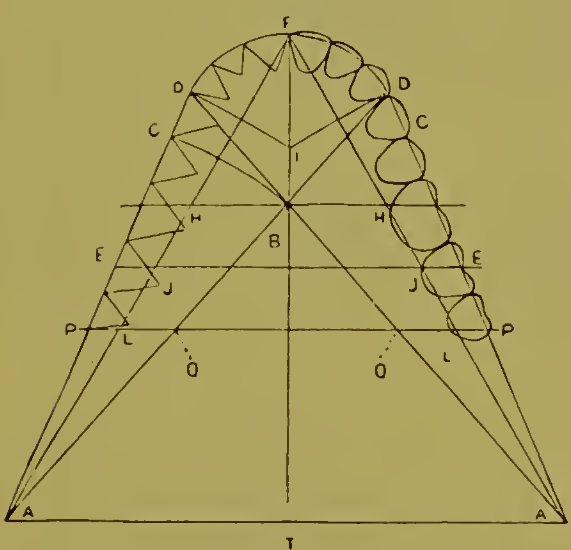
By C. A. HAWLEY, D.D.S., Columbus, O.

In considering cases in orthodontia where the teeth are malposed and the form of the arch consequently distorted, the question naturally arises, "What is the proper arch for these teeth"? If they are normal and uniform in size, there must be some particular arch for them which they will exactly fill, and its form and the position of the contact points and occlusion be correct. Heretofore the judgment of the eye, trained by observation of what seem to be the most perfect specimens of nature's work, has been the only guide; but human judgment of this kind is apt to err, and the object of the investigation described in this paper is to find some data that will be accurate and exact and form a trustworthy guide.

Dr. Bonwill, in his valuable work on the articulation of the teeth and the movement of the jaws in mastication, outlined the geometrical principles on which the movements of the jaws are based, and the form of an ideal arch. This arch is constructed upon the equilateral triangle, and with slight modifications has been universally accepted as correct, and forms the basis of the most advanced teaching on this subject. It is shown in the familiar illustration (Fig. 1), the base A A representing the distance between the condyles, the apex of the triangle resting between the central incisor teeth at the cutting edges. The six front teeth are arranged in an arc of a circle the radius of which is determined by the combined widths of the

central, lateral, and canine teeth. From the distal point of the canine the bicuspids and molars are arranged in straight lines passing to the extremities of the base of the triangle, the points of the buccal cusps being cut by the line. The line drawn through B passes through the middle point between the buccal cusps of the first molars. In commenting on this arrangement of teeth, the author of the article on the subject in "The American

Fig. 1.



Text-Book of Prosthetic Dentistry," from which the drawing is taken, says: "In natural dentures the second and third molars are turned slightly toward the median line and the line drawn through B more often passes through the crest of the disto-buccal cusps of the first molars." These modifications are, I think, generally accepted as correct.

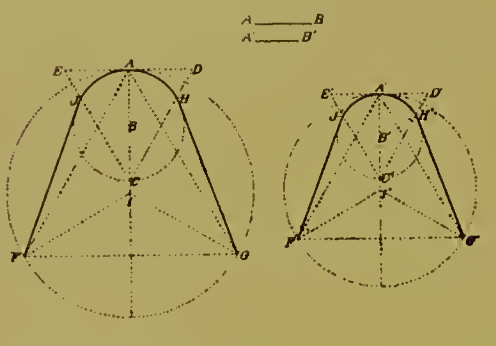
In the practical application of this form of arch to the arrangement of artificial teeth, Dr. Bonwill constructed an articulator upon the basis of a four-inch equilateral triangle, this having been found to be the average width between the condyles in an examination of a great number of skulls, the width varying from three and one-half to five inches. The casts were mounted on this articulator in such a manner as to copy the form of the natural denture. In setting the teeth, the centrals, laterals, and canines were arranged in the arc of a circle the radius of which was determined by their widths. The bicuspids and molars were carried back in a straight line not exactly to the base of the four-inch triangle represented by the articulator, but moved inward or outward to bring the stress of mastication as nearly as possible over the ridge and still preserve the proper lateral movement of the jaw as represented by the articulator. The exact width between the molars is thus determined by the judgment of the operator, or the conditions or position of the ridge. Unless this were done, narrow teeth arranged in a four-inch triangle would be too wide in the molar region and, *vice versa,* wide teeth too narrow.

In orthodontia we meet a different problem. We have presented a set of teeth to rearrange in the living subject. We can determine the exact widths of the teeth. There is no means of measuring the width between the condyles with any degree of accuracy, and we cannot place them in the average arch based upon the four-inch triangle. The arch must be found from some other data, and we will select the front teeth.

Take as an example any case, and from the combined widths of the central, lateral, and cuspid as a radius, draw a circle *A H C* (Fig. 2). Measure the radius upon the circumference of the circle at *H* and *J*, marking the distal points of the cuspids. From *C* the end of the diameter of the circle, drawn through *A* and *B,* draw the lines *C D* and *C E* through *H* and *J,* extending

them indefinitely. Draw a tangent to the circle at *A* cutting these lines at *D* and *E*, forming the equilateral triangle *C D E*. Take one side of this triangle as the radius of a circle passing through *A* with the center *I* upon the extension of the line *A C*. From *A* mark off the radius of the circle upon the circumference six times and draw the inscribed triangle *A F G*. Draw the lines *F J* and *G H*. We have now an arch based upon and arranged with an equilateral triangle, but proportional to the widths of the three front teeth, or the radius *A B*.

Fig. 2.



To prove that such diagrams will always be similar and proportional to the radii, from the radius *A′ B′* draw another diagram supposed to represent a smaller set of teeth. In similar triangles the corresponding dimensions are always proportional. The triangles *C D E* and *C′ D′ E′* are similar because they are both equilateral. They are constructed upon altitudes *A C* and *A′ C′* equal respectively to twice the radii of the circles *A H C* and *A′ H′ C′*. Therefore, the base *E D* is to the base *E′ D′* as the radius *A B* is to the radius *A′ B′*. But *E D* and *E′ D′* are by construction equal respectively to the radii of the circles *A G F* and *A′ G′ F′*. From the centers of the latter circles draw *I F*, *I G*, *I′ F′* and *I′ G′*. The triangles *I F G* and *I′ F′ G′* are similar since they are equiangular (*A F G* and *A′ F′ G′* being equilateral triangles). Therefore *F G* is to *F′ G′* as *I G* is to *I′ G′* or as *E D* is to *E′ D′* or as *A B* is to *A′ B′*. Or if the arch presented is an ideal one, we may, from any widths of teeth given, construct a similar arch proportional to the given set of teeth.

Having the arch drawn, the teeth may be laid off on it, with a pair of dividers from measurements on the plaster cast, thus locating their exact positions, as shown in Fig. 3. In this figure the widths of the teeth are marked above the arch. They are actually marked by needle points in the paper, but here are inked in order to show better in the photograph. In measuring off the front teeth there is a small space, about one-thirty-second inch, between the cuspid and first bicuspid. This is because the widths of the teeth are taken in a straight line and are measured off on a curve. Notice that the line *O P* passing through *B* parallel to the base of the triangle, passes through the crest of the disto-buccal cusps of the first molars. I

Fig. 3.

have found this true of every case that I have drawn. Variations in the proportional widths of the bicuspids might cause it to vary slightly, but I have not yet found such a case.

The second molars are turned slightly toward the median line. The lower arch is drawn from measurements of the lower teeth. The lines drawn across it show corresponding measurements taken from the cast with a pair of compasses from tip to tip of the buccal cusps of the bicuspids and from the crest of the mesiobuccal cusps of the molars. They exactly correspond, and if our arch is ideal, then the casts show not only a perfect occlusion but a correctly formed arch as determined from the widths of the teeth. The subject from whom the casts were made is of lymphatic temperament.

FIG. 4.

Drawings made from different cases will vary in appearance in accordance with the characteristics of the teeth themselves, yet all will be symmetrical. This is shown in three cases in Fig. 4, where the combined widths of the three teeth in each case are respectively ninety-two, ninety-four, and ninety-eight one-hundredths of an inch.

While Dr. Bonwill's arch has been universally accepted as ideal, and the geometrical demonstration shows that it can be accurately reproduced from the data previously taken, yet it will be interesting to follow its application to several cases. In Fig. 5 we have the occlusion of a pair of casts kindly loaned me by Dr. M. T. Watson. Not only are these casts perfect in occlusion, but the form of the arch, as shown in Fig. 6, is equally faultless. At the side is a diagram drawn from the widths of the

FIG. 5.

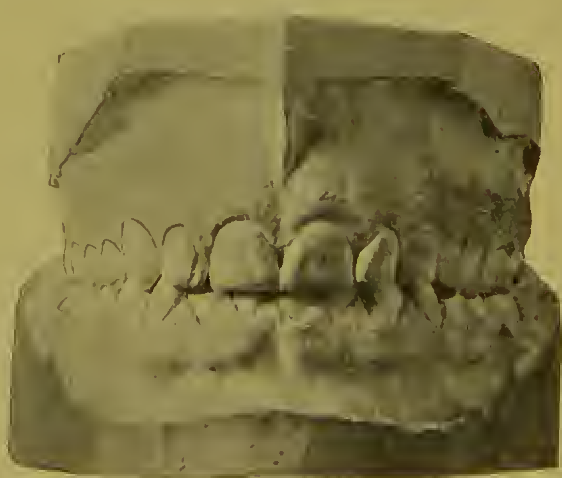


Fig. 7 shows casts of a subject of nervous temperament. The occlusion is not perfect on the right side, the lower first molar having been extracted and the space closed. In Fig. 8 we see the

form of the arch and a diagram of the upper teeth drawn from the same data as before. This arch in all essential points conforms to the diagram, though there are some deviations. The buccal cusps of the first molars are turned outward slightly and the arch on the line of the first bicuspids is a little narrow, owing probably to the readjustment after extraction. Yet it is an arch that would be generally considered unusually well developed.

Fig. 6.

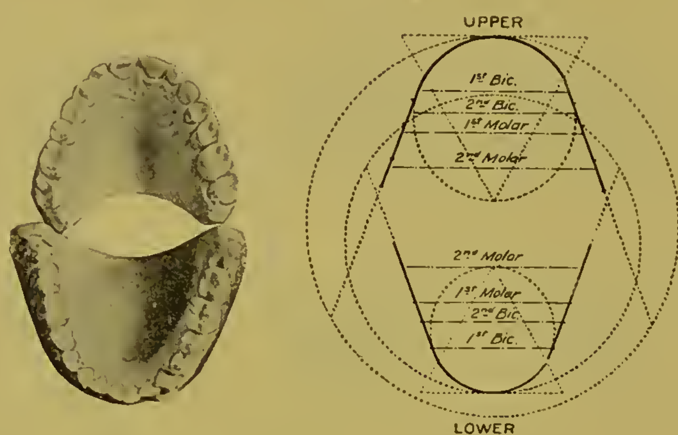


Fig. 9 shows the left side of a skull with good occlusion. The form of the arch is nearly perfect, as shown in Fig. 10.

Having shown these cases of perfect arches and compared them with the diagrams we will now consider some deviations. First the left side of a skull with good occlusion (Fig. 11), also (Fig. 12) the form of the arch with a diagram beside it. It is, as you see, too narrow, the lines of measurement stopping short in every tooth.

Next I wish to show (Fig. 13) the occlusal views of these two skulls together for comparison. It is interesting to note that the combined widths of the three teeth in No. 2, the narrow arch, are one-thirty-second of an inch wider than those in No. 1, making the base of the triangle upon which the arch is drawn one-fourth of an inch longer. The bases of these triangles when measured on their respective skulls each reach from center to center of the glenoid fossa, as shown by the black marks in the photographs. I have had neither time nor opportunity to examine other skulls, but in these two cases the determination of the triangle on which the teeth should be arranged has also determined the distance from center to center of the glenoid fossa. It is also interesting to note that the opening of the posterior nares in the narrow arch is very much smaller than in the normal case.

Fig. 7.

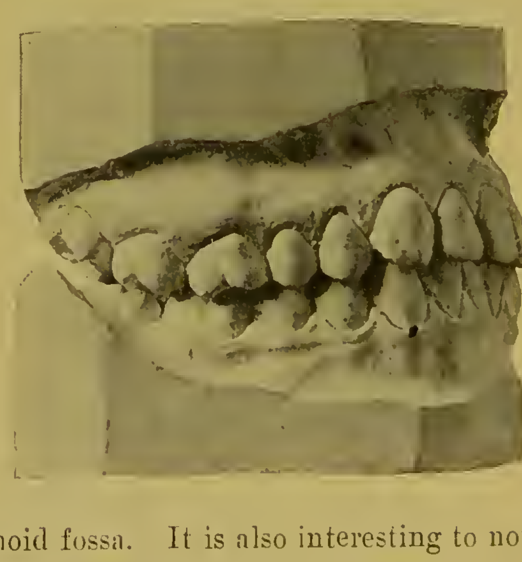
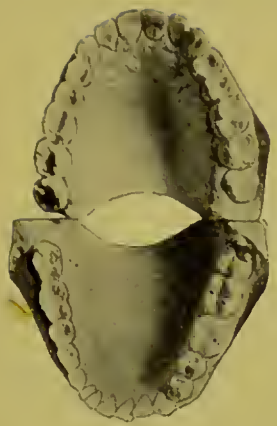


Fig. 8.



In Fig. 14 we have casts of the teeth of a man past maturity, in perfect occlusion and an unusually well-developed denture.

Next (Fig. 15) is the occlusal view and diagram. This arch is five-sixteenths of an inch too wide at the first molars, something very unusual and the only case I have ever seen where both arches were too wide. The diagram locates accurately the trouble. The first bicuspids are in correct positions, the width between the canines too narrow, and back of the first bicuspids all too wide. If this case were to be treated the movement required is accurately indicated.

Fig. 9.

Fig. 16 shows casts of the teeth of a girl of fourteen, in good occlusion though not fully erupted. But the arch (Fig. 17) is too narrow and some of the teeth are in slight malposition.

To illustrate the application of this method to practical work, I will present four cases. Fig. 18 shows the first case before correction. It is a simple case of class I; it presents no particular difficulty

Fig. 10.

Fig. 11.

but serves to show the accuracy of working by this method. Fig. 19 shows the tion, with a diagram of the ideal arch made at the commencement of the work.

Fig. 12.

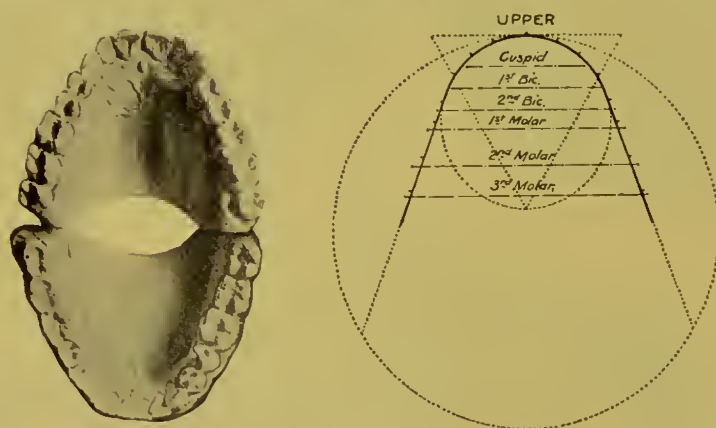
Fig. 13.

case after correction, and Fig. 20 the occlusal views before and after correc- The measurement lines across the molars and bicuspids are taken from the cor-

FIG. 14.

rected case. In this case only the skeleton arch was made; in others I have drawn in the teeth to give a more natural appearance and also to allow measurements to be made from the lingual cusps or any other part of the tooth most convenient. The diagram indicated that an expansion of one-fourth of an inch was necessary in the molar region. The drawing is kept at hand and at any point in the progress of the work measurements can be taken with a small pair of compasses and the exact movement noted by comparing with the diagram. In case the arch needs lengthening, the necessary movement and its progress can be shown by measuring from some point on the molars to the front teeth.

FIG. 15.



Figs. 21, 22 and 23 show the second case before and after correction, with the occlusal view of the arches and the working diagram. The expansion in this case was three-sixteenths of an inch. I have chosen this and the preceding case for illustration because in neither of them is the required expansion great, and the mistake might easily be made of not expanding at all. The width of the last arch is unusually great when completed, as the distance from crest to crest of the mesio-buccal cusp of the first molars is two and one-fourth inches. The casts of all the finished cases, I may say here, were also taken at the same time, before the teeth were settled into position.

FIG. 16.

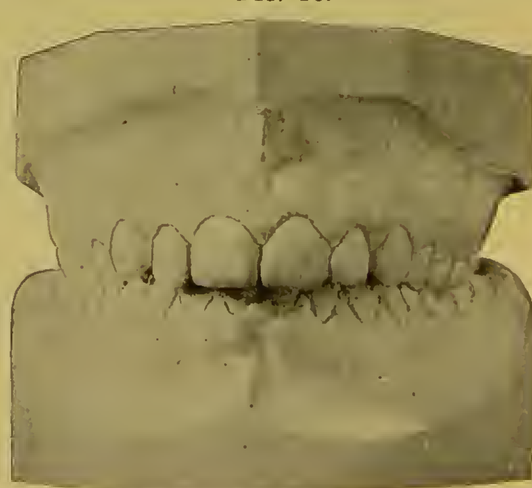
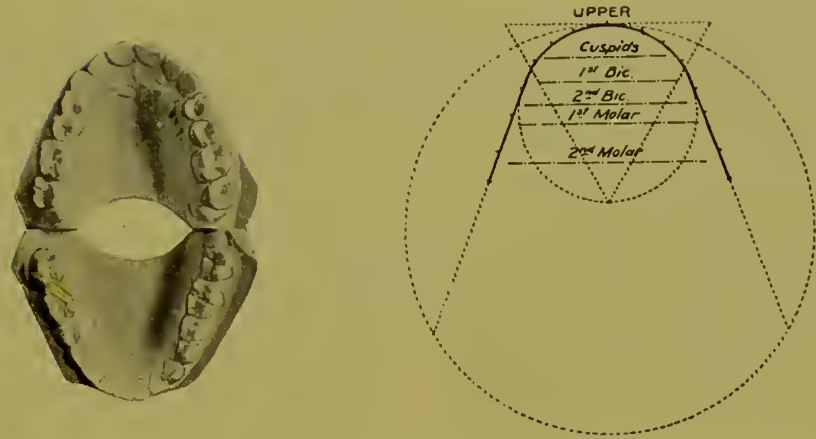


Fig. 17.



The next case (Figs. 24, 25, and 26) shows more extensive movement. There is great contraction of the arches, and while the molars on both sides are in correct occlusion, the non-eruption of the left second bicuspid has allowed the lower arch to shorten, the left first bicuspid drifting to distal occlusion. In correcting, the diagram gave me not only the normal width of the arches but also the proper length of the lower.

Case four (Fig. 27) has some interesting features. The space for the left cuspid was completely closed and the lower

Fig. 18.

Fig. 19.

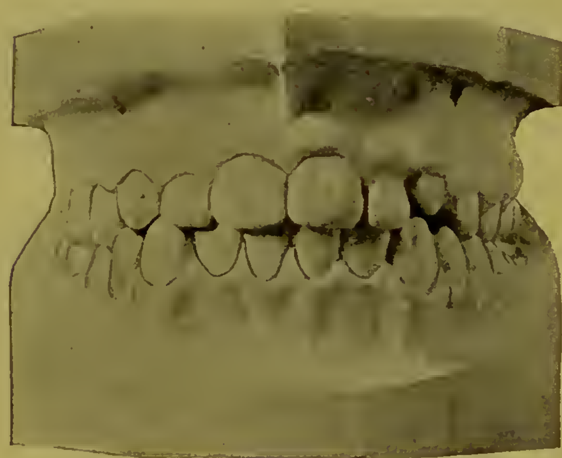


Fig. 20.

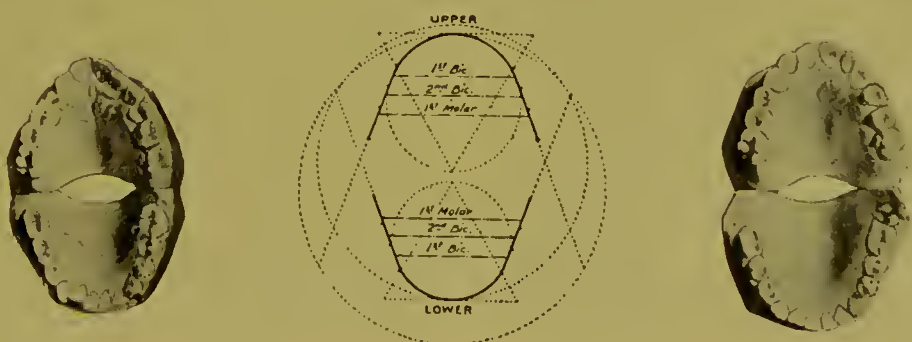


FIG. 21.

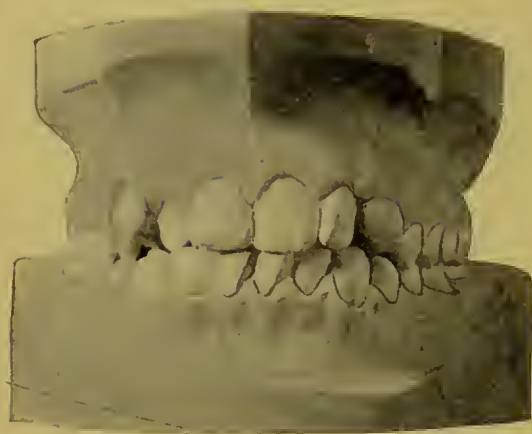


FIG. 22.

FIG. 23.

FIG. 24.

FIG. 25.

jaw forced back to a position distal to normal, the teeth occluding end to end. The space was opened by carrying the incisors forward and mesially on that side, with the result shown in Fig. 28. The occlusal view shows that the form of the arch was good. The question presented was, "How much larger must the arch be made to accommodate one more tooth?" The diagram (Fig. 29) indicated both the amount of expansion and lengthening exactly, and the movement

Fig. 26.

was accomplished with accuracy and precision.

It is not necessary in estimating the value of this method to contend that the full width of the arch indicated must always be obtained or that any hard and fast rules must be followed. Conditions may justify stopping short of full expansion, but in all cases it is valuable to know the exact form of the normal arch, and then such variations from it may be made as the judgment of the operator indicates. In case of deformed teeth, as for example peg laterals, the size of the upper arch can be determined from the lower, as it is very unusual to find such a deformity in both arches.

Fig. 27.

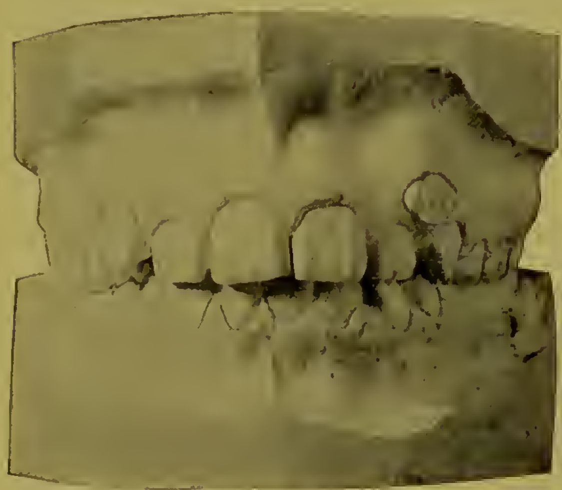


Fig. 28.

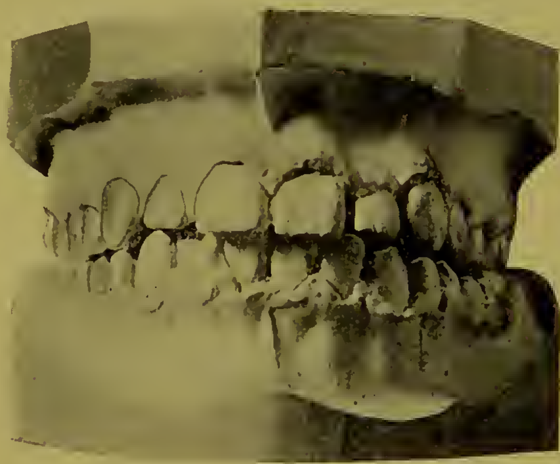


Fig. 29.

Its value in diagnosis is evident and needs little argument. It furnishes an accurate basis for study of any case.

Especially by the young operator and student should the method be followed until the normal form of the arch is firmly and accurately fixed in the mind. Even when it is so formed, it is difficult to judge in the mouth with appliances adjusted; but measurements can easily be taken and comparisons made at any time that will give the exact conditions.

Discussion.

Dr. R. Ottolengui, New York, N. Y. I had the honor of being present when Dr. Bonwill read his first paper on the subject of the scientific arrangement of artificial teeth and the scientific study of occlusion. I remember very well that he stipulated, himself being thoroughly aware of the value of his paper, that an entire evening should be given to it. There was a large gathering present, and he read a paper which was an hour or two long, and by the time he had finished there was scarcely one of the audience left. I want you to contrast that time with this, when Dr. Bonwill's work and his method is recognized, although curiously enough that recognition began in the year of his death. To-day we have a very similar paper, and I think the first of its kind endeavoring to erect a standard by which we may re-arrange the natural teeth in their natural order.

Dr. N. S. Hoff, Ann Arbor, Mich. The subject of the paper is largely a mathematical proposition—a geometrical problem at least, which as we know admits of little or no discussion. The chairman suggested in his paper that we should reduce orthodontia to definite principles, but I don't know whether we can reduce it to mathematical principles or not. Biology is not a mathematical science, and the science of orthodontia comes under the heading of biology rather than chemistry or mathematics. It is not one of the exact sciences and it seems to me it would be very unwise and undesirable to reduce the work of orthodontia to mathematical formulæ, because if we do that we put ourselves more or less under obligations to mathematical rules which are arbitrary and restricting. I think this application of the principle which Dr. Bonwill has worked out for us is a very happy thought, and I have no doubt it will prove to be very useful as a standard—not an exact mathematical standard, such as the presentation would lead us to believe possible for every case. We cannot measure the human countenance in fractions of inches, and no more can we measure the exact positions of teeth in the mouth. No two persons or individuals are made up mathematically upon the same lines. No two persons are of the same type, or size, or features, so we cannot apply definite mathematical formulæ to this work. I fear that if we undertake to make our work conform to mathematical formulæ we shall produce results that will be wholly inartistic. Those of you who have tried to fit this formula which Dr. Bonwill first laid down for use in prosthesis will recall the many failures you have met in adjusting artificial teeth on these lines, and fitting them in the mouth only to find inharmonious results. I think that if we follow that principle strictly in orthodontia we shall meet with the same unfortunate results.

I believe that the art feature of our work is equal to, or I might say more important than the mathematical or exact feature. It will not do for us to

adopt so exact a formula and work too closely to it. That which leads to general harmony is of much greater importance. It is good to have a standard, but we should use it with intelligent discretion. The idea is a most happy one when properly used, and I thank the essayist for presenting it.

Dr. M. T. WATSON, Detroit, Mich. Some weeks after Dr. Hawley had been invited to read this paper before the congress he came to Detroit, and we spent an entire day making comparisons of some of my finished cases with the results obtained by drawings made according to this formula, and to our great delight found that the cases where I had obtained the best results, both esthetic and otherwise, were those most nearly conforming to the measured diagrams.

Dr. Hoff has brought up the point of the inartistic results that are sometimes attained when one confines himself to the Bonwill law in the making of artificial dentures. In orthodontia we have not this difficulty, because we have teeth the size that nature meant them to be. In prosthetic work we have the size of teeth that man selects, and man's judgment is often in error; so I can very readily see how inartistic results might follow. I do not believe that Dr. Hawley himself thinks that every man should make drawings of each case he treats, but I can see where it will be of the greatest value to beginners, those who have not had sufficient experience to tell at a glance whether the arch is the proper width or not. I meet many cases where it is a problem whether the arch is of the right width, and certainly with this very exact formula to work by many of these difficult questions will no longer trouble us; they can be settled mathematically.

I am convinced, that it is a system of great value, and I want to express my appreciation to Dr. Hawley for bringing this subject to us and for the very thorough manner in which he has done it.

Dr. F. A. GOUGH, Brooklyn, N. Y. In relation to the objections made to Dr. Bonwill's law, in this case the essayist has given us a rule and we figure out a different proposition for each different case; it is much more exact than Bonwill's law.

Dr. G. D. SITHERWOOD, Bloomington, Ill. We have the lines of the face and of the human body both measured out, and while I do not agree that we could make a mathematical line as a standard alone, for of course the artistic comes into play all the while, yet it is certainly a valuable paper. It gives a standard of measurement of width and of lines by which we can take measurements of the sizes of the jaws and teeth, and some of the lines are good measurements to go by as a standard. Yet at the same time, every man who practices orthodontia has to bring in the artistic element, as Dr. Hoff has well said, but taking Dr. Hawley's formula as a foundation we can then bring in the artistic and use our own judgment as to the lines of beauty and measurement of what should be the perfect end in view in regulating teeth in the human arch.

The CHAIRMAN. I would feel guilty if I did not say that I appreciate very highly this paper—not that I think it is conclusive, by any means, but I think it is a true step in the direction of real science, which, you know, is only classified knowledge, and this is classifying knowledge.

There is far too much guess-work in orthodontia. You know it has practically all been guess-work as to art, diag-

nosis, and treatment until very recently. Now we have well-defined principles to guide us on all these points. We can eliminate most of the guessing, and this paper is directly in the line of the elimination of guessing and looking toward system and accuracy, and while none of us can place the proper value on it without first having much experience with it, yet orthodontists know enough about the principles of occlusion and Bonwill's law to know that it may be of great value in determining the form and position of the line of occlusion.

I do not think it probable that we will ever adhere strictly, rigidly, mathematically to this rule, as Dr. Hoff has said, for the reason that the halves of the arches, and for that matter the halves of our anatomy throughout, are never exactly alike. So to attempt the rigid, accurate adherence to fixed rules would be to violate the requirements of art and of anatomy; but these are minor points when applied to the principle under discussion. If it can furnish a good, intelligent rule on which to base our judgment as to the correct positions of the teeth, and I think it can, it will prove of much value, especially to the beginner in orthodontia.

Dr. Hawley (closing the discussion). A number of questions have been raised in this discussion that are questions in my own mind as well as yours. The time I have been working along this line has been too short to decide them. I am inclined to believe that in highly civilized persons—the people we work with in orthodontia—this form of arch will produce in every case the most artistic development of the face. I would like to find that nature has made few mistakes, that she has given to every person a form and size of teeth which if placed in a normal arch will best develop the harmony and beauty of the face. The indication of all the facts I have been able to collect in the time I have been working on this matter seem to point that way. The teeth in their shape and contact points seem designed to fill this form of arch and we know that they are better preserved through life when the arch and consequently the contact points are perfect, and retention is easier too, for the arch is more nearly self-supporting. There are many things to be developed; for instance, I believe that we will find some relation between the sizes of the teeth, so that in cases where only part of the teeth are erupted we can find the size of the arch from one or two teeth alone. Of course there will be exceptions and abnormal cases, but they do not affect the general rule. And the form of the arch in the lower races may be different, but we do not regulate teeth for them.

In working from this plan the measurements must be accurately taken and the drawing carefully done. Any careless work is useless.

The Chairman. One of our German friends, Dr. Franz Zeliska of Vienna, Austria, although not able to be present with us today, has favored us with an excellent paper. It is entitled "The Influence of Atmospheric Pressure upon the Molding of the Dental Arch." As Dr. Richard Summa of this city has made a study of this paper, I will ask him to read it.

Before reading the paper Dr. Summa stated that it was written in German and that his reading of it would be a translation.

The paper was as follows:

The Influence of Atmospheric Pressure upon the Molding of the Dental Arch.

By Dr. FRANZ ZELISKA, Vienna, Austria.

We frequently meet in dental literature, especially in treatises upon orthodontia, the expressions "cheek pressure" and "lip pressure," without any attempt on the part of the authors to define their individual conception of these terms, and they hint but obscurely that they imply muscular tension and the weight of the soft tissues.

My highly esteemed teacher, Prof. Partsch of Breslau, has given an explanation of these terms which appears to me to be the only correct one, and it will be my endeavor in this paper to acquaint the orthodontists with his idea concerning this matter.

The active force manifesting itself as cheek and lip pressure is, according to Partsch, nothing but atmospheric pressure. The degree of this type of pressure being but slight, its influence upon the position of the teeth is due to its constancy, and its significance becomes apparent only when it is absent on account of pathologic conditions.

At the outset it must be clear that atmospheric pressure, as such, is ineffective, but that it exerts its influence indirectly because of the existing difference of pressure within and without the mouth. That such a difference exists is known to us.

The oral cavity presents in normal condition, when the mandible is at rest, a chamber devoid of air or at least one containing but a small amount. For a better understanding I will quote the physiological investigations of Metzger and Donders. Metzger arrives at the following conclusions:

"By means of the muscles inserted in it, the mandible is held in a state of equilibrium in such manner that by the contraction of certain groups of muscles the various movements are brought about. However, an absolute equilibrium is not produced by the muscular tension alone. Rational reasons as well as experiences readily gained by simple experiments will eliminate the teaching that the mandible is held suspended by the muscles of mastication. While one can keep the mouth closed for hours without experiencing the slightest inconvenience, and certainly not be aware of the tension of the temporal muscles which are being strained by constant pulling, we readily become conscious of this fact if one tries to breathe but for five minutes with a minimum parting of the lips and a complete and even relaxation of the muscles, the mandible at the same time exerting a slight tension upon the above-mentioned muscles. The sensation of stretching the temporal muscle is greatly increased if we add only slightly to the natural weight of the mandible.

"Though the desire be strong to retain these muscles in a state of relaxation, fatigue will be experienced and an involuntary contraction of the stretched muscles will take place.

"We may observe another occurrence whenever the mandible is separated from the maxilla while the mouth is closed. We will feel the mucous membrane on both sides drawn in folds between the arches, and at the same time a discharge of saliva into the mouth takes place. If the dental arches are separated still farther the lips will part with a noise plainly audible and the folds of mucous membrane will straighten out. In the meantime, respiration can be carried on constantly through the nose without causing any change in these conditions. The tongue shuts off the current of air from the artificially formed cavity.

"When the mouth is open the tongue rests upon the floor of the oral cavity. However, when it forms the hermetic partition between these curved surfaces which in this case form the oral cavity and the respiratory passage, it points forward and upward, adapting itself closely to the upper front teeth (in case of missing teeth the tongue is pressed through these spaces until it touches the lip), the alveolar process and palate. The root of the tongue rises until it touches the back teeth and corresponding parts of the maxilla. It is very evident that the mouth can remain closed without any tension and uncomfortable drawing of the muscles. The lower surface of the tongue rests upon the rim of the lower jaw and the entire tongue together with the underlying parts are being supported by atmospheric pressure."

The experiments of Metzger have been confirmed and continued by Donders, as recorded in the "Archiv für die Gesammte Physiologie des Menschen und der Thiere."

Donders writes: "While the mouth is closed in the ordinary manner, a flat mouthpiece connected with a manometer by means of an elastic tube is introduced between the lips and teeth and above the tongue almost to the soft palate. This will demonstrate that in the chamber located between the anterior part of the tongue, which is in contact with the hard palate, and the soft palate, which is stretched over the root of the tongue, there exists a negative pressure of 2–4 mm. mercury. If a colored water solution is used the manometer indicates a higher value. . . . .

"Respiration is carried on regularly without exerting any direct influence upon the manometer. To be convinced of this, it is but necessary to increase the inhalation and exhalation pressure by closing the nostrils. Furthermore, a mouthpiece adapted to the form of the tongue may be pushed along the root of the tongue until the respiratory passage is reached. It will be found that this passage is farther back as well as lower than one would suspect. It is here that the palate is stretched downward over the root of the tongue.

"While the mouthpiece is in the suction chamber the fluid in the manometer will show slight respiratory oscillations which are dependent upon the inhalation and exhalation pressure upon the soft palate. If one of the nostrils be closed these oscillations will increase, and they will increase still more if the other nostril is also compressed, without any direct connection existing between the respired air and the existing suction chamber. This suction chamber is closed in front by the tongue. The mouth can be opened, the lips and jaws separated from one another, and still one can plainly feel that the tongue rests against the palate. This suction can be voluntarily increased by first flattening the tongue, then drawing it posteriorly and

bending the tip backward. In withdrawing the tongue a sound—so-called smacking of the tongue—is heard. This sound is caused by the air rushing into the suction chamber. If any object be introduced over the tongue into the suetion chamber, it will be sucked backward. If this object be hollow, fluids ean be drawn into the suction chamber. Enlargement of the suction chamber is brought about by drawing the root of the tongue backward. This is noticeable externally by a thickening above the hyoid. By doing this a negative pressure of more than 100 mm. mercury can be produced. This is the chief feature in the mechanism of mastication.

"For a second experiment a mouthpiece may be introduced between the lips and teeth and under the tonguc. Care must be takcn that the muscles are perfectly inactive. In this case the manometer will show no change, or at least but a faintly negative pressure, for in reality no chamber exists. The tongue is in close contact with thc alveolar process on both sides; its upper surface toward the front is in contact with the roof of the hard palate; the lower surface touches the floor of thc oral cavity; thc tip of the tongue and its other sides rest closely against the teeth, to which the lips are adapted on the other side.

"The lips can be drawn in still farther voluntarily and, if they arc not pressed together too tightly, somc air can be heard rushing in between them. By this suction the front part of the tongue is drawn backward and anothcr suction chamber is formed betwcen thc lower surface of the tongue, thc bottom of the oral eavity, and the lips. To producc this anterior suetion chamber and to observe the suction of thc lips, it is not necessary to perform thc act of suction. It is sufficient to draw thc tongue backward while the mouth is closed in the ordinary manner. Should the teeth become slightly separated the lips will be drawn in.

"We have lcarned that in ordinary closure of the mouth there is practically no anterior suction chamber. However, in parting the lips a faint sound is heard in consequence of the sudden admission of air, showing that bccause of the adhesion of the lips a chamber had formed while they wcre being separatcd. By a little practice of allowing the tonguc to rest against the palate (for the natural move would now be drawing the tongue away) moving the tongue downward a second sound is produccd by breaking the adhesion of the lower surface of the tongue to the bottom of thc oral cavity.

"Accordingly, we conclude that when the mouth is elosed the tonguc is drawn into eontact with the roof of the mouth chiefly by virtue of its own muscular activity, the lips adhere and the bottom of the oral cavity is also bound to the lower jaw by adhesion. In this manner, as Metzger has correctly statcd, the mandible is being sustained. It is immaterial whether the anterior suction ehamber containing little air exists, for it is certain that it would form if thc adhesions were not sufficient to retain the surfaces in contact with one anothcr—thc same condition as in the hip-joint."

Thesc explanations tcach us that the oral cavity contains a chamber of small dimension which, if not cntircly devoid of air, contains only little air, so that a diffcrencc of atmospheric pressure from within and from without cxists.

Furthermore, in consequenee of this diffcrence of pressurc, the outer atmospherc bcars upon the walls of this chamber, *i.e.* thc lips and eheeks, and these in

turn upon the teeth. Though the intensity of this pressure is but slight, it is effective because of its constancy, the mouth being closed the greater part of the day and the entire night.

It is this atmospheric pressure which we are in the habit of referring to as lip pressure and cheek pressure. It is this pressure which retains the mandible in its relation to the maxilla.

It is an old-established fact that this pressure is not the only factor concerned in molding the dental arches; the tongue also exerts a great influence, somewhat antagonistic, as it were, to the cheek and lip pressure. In normal conditions these forces act harmoniously.

The size and shape of the tongue exert their influence primarily upon the lower arch because it rests in the bottom of the oral cavity. Only the anterior part of the upper arch is directly affected by the tongue, and the entire upper arch is only indirectly influenced by it, because the lower arch is the mold over which the upper is formed.

The importance of these factors is reflected in the successes in the practice of orthodontia. Here we may clearly see the influence of atmospheric pressure and its various manifestations. If, after the correction of malposed teeth and the removal of retainers, the desired result is permanently established, or if, on the contrary, the correction has not been effected in accordance with the laws of occlusion, the results must alike be attributed to that atmospheric pressure manifesting itself as mandibular pressure.

In this we also find an explanation for that form of malocclusion so typical of the mouth-breather, expressed as class II, div. 1, Angle's classification. It is plain that in the mouth-breather the chamber which in the normal breather contains thinned air, is missing. Lip, cheek and mandibular pressure are absent; the tongue acts only upon the mandible and upper front teeth. There being no lip pressure, the upper first permanent molar, instead of making its way through the bone tissue between the second deciduous molar and the tuberosity, will push the deciduous arch forward and assume a position mesial to normal, a result similar to that produced by premature extraction of the second deciduous molar. The maxilla will be protruded and narrowed, not because of the tension of the muscles of the cheeks occasioned by the dropping of the mandible, but because the activity of the tongue is missing, and because the teeth can create sufficient space by elongating the mandible; only the tip of the tongue exerts pressure upon the upper front teeth and places them obliquely at an obtuse angle.

It is to be attributed to the atmospheric pressure known to us as lip pressure that the crowded front teeth which immediately after correction appear too oblique, assume the proper slant in the course of time.

It is, therefore, of the greatest importance that the orthodontist should consider atmospheric pressure as one of his important therapeutic measures, and to establish normal breathing and normal atmospheric pressure in the oral cavity he must work hand in hand with the rhinologist.

Discussion.

Dr. J. P. Corley, Greensboro, Ala. We are now beginning to see and recognize the fact that the shape of the dental arch is one of the most powerful factors

in the symmetrical development of the face and in all of its far-reaching consequences.

I have for some time been studying the influences which are brought to bear upon the alveolar or dental arch, but I have never thought of this one, and for some time I have been collecting models and photographs of cases which present asymmetry along the line of dental irregularities. Now, if atmospheric pressure can be proved to be a factor in the development of the abnormal dental arch, and we are able to control that pressure so as to obtain symmetrical development of the arch, then we will contribute to humanity one of its greatest blessings, because where there is any lack of symmetry in the dental arch we find a corresponding lack of symmetry in the features of the face. I have been observing deflections of the nasal septum, disparity in the shape of the orbits, and also in the sizes of the maxillary sinuses, and I find that they are invariably concomitant with an abnormal development of the dental arch. I am convinced that not only deflections of the nasal septum are almost without exception responsible for corresponding deflections of the dental arch, but that a great many ocular disturbances have their origin in the same source. We have flattening atrophy, undue elongation of the orbit, and deflection of the visual axes. I believe that if we could interest opticians, oculists, and rhinologists in this cause and obtain their assistance along this line—if we could induce them to keep records and data of the conditions they find in the development of the dental arch, I think we would in a few years work out some scientific principle which might be of great assistance.

I believe that if specialists would keep copies of their models of symmetrical arches and of irregularities, preserve them in a register, and make out data concerning the conditions which they find, we would in a few years be in position to work in harmony to contribute untold benefit to humanity.

Dr. W. O. Talbot, New Orleans, La. This paper is a very interesting one, since it concerns a solution for the cause of cases of class II, div. 1, according to the Angle classification. But in going over the experiment in accordance with the directions given in the paper, I am unable to arrive at the conclusions therein reached. For instance, if we close the mouth normally and continue to breathe we produce a slight vacuum or have a cavity of thin air in the roof of the mouth. By increasing the vacuum or rarity of the air in the mouth, the cheeks are forced in against the teeth. It is evident to my mind that atmospheric pressure has something to do with holding the mandible in its normal position, and supporting it when the teeth are in occlusion, while if we open the mouth and continue to breathe, the atmosphere is of equal density in the mouth and without, and the pressure is relieved so that we do not have the inequality of pressure that we had before to support the mandible. The stretching of the masseter muscles presses the bicuspids and the molars in, as they are not supported by the tongue from the inside when the mouth is open.

I do not think that unequal air pressure accounts for the disproportion of the arches in the mouth-breathers.

Dr. W. O. Talbot, New Orleans, La., then read a paper entitled "Malocclusion, the Deformity of the Age," as follows:

Malocclusion, the Deformity of the Age.

By W. O. TALBOT, D.D.S., New Orleans, La.

Malocclusion is the misfitting of the occlusal planes of the teeth when the jaws are closed. This condition becomes a deformity when there is an irregularity in the arrangement of the teeth in the arch, a disproportion or an unnatural development of either or both of the maxillæ to such an extent as to destroy the beauty, expression, and harmony of the features.

Prevalence. The most common external deformities of the body—excepting of course deformities resulting from malocclusion—are humpback, club-foot, inequality of limbs, and hare-lip. All combined, they will sink into insignificance when compared in number with those of malocclusion. One may walk the crowded streets of a city, seeing here and there distorted or disproportioned figures, but if we look closely into every face we will observe that more than 75 per cent. carry an unnatural expression about the mouth, the cause of which is at once revealed to the student of facial expression as related to malocclusion.

Outward signs of malocclusion. The Greek and the Roman types are taken as the standard forms by which we determine the deviation from the natural lines of development of the face. The Greek type—considered the most beautiful—is marked by straight lines joined by short curves, small depression at root of the nose, upper lip short, lips thin and finely cut, and chin round. The Roman type is marked by vigorous lines, more development of the features, chin, mouth, nose, and brow. The Roman may be handsome, the Greek beautiful, and through inheritance the two types may be combined without lessening the attractiveness of the features. The combination of these types make up the varied forms of faces which are often very beautiful and much admired; but under the powerful influences of heredity and malocclusion, the features are frequently made conspicuous and the expression even absurd. The more noticeable defects arising from malocclusion are thinness of face, depressed lips from contracted arches, protruding upper lip and the acute angle under the nose caused by protruding incisors, a defect more conspicuous in the Greek than in the Roman, yet quite common, indeed, in the latter. The retruding upper lip and obtuse angle under the nose of the Greek, caused by retruding upper front teeth, insufficient teeth, or lack of development of the maxilla, is also conspicuous but less objectionable in the Greek than in the Roman, in whom it adds prominence to the nose and becomes absurd. The retrusion of the mandible or lower arch, with the lower lip turned over, an acute or distinct angle below it, is absurd in the Greek but more tolerable in the Roman. The protruding chin, projecting the lower lip beyond the upper and destroying the natural curve of the lower lip in the Greek and the angle in the Roman, is conspicuous in both types, but less objectionable in the Greek than in the Roman.

Where found. From personal observation I conclude that these deformities are much more common in cities than in the country, though exceedingly abundant everywhere. My experience is not as yet sufficiently extensive to make a comparison between different sections of the country.

Causes. The two great divisions of causes of malocclusion are (1) those which are inherited and (2) those which are acquired. The acquired causes are by far the more common, and the dental profession generally agree that under this head should be classed: Premature loss of deciduous teeth, prolonged retention of deciduous teeth, loss of permanent teeth, tardy eruption of permanent teeth, supernumerary teeth, habits, disuse, nasal obstructions, and abnormal frenum labium.* When these influences affect only the position of the teeth and the width of the arches, the assignment of the proper cause is not difficult. The influence of heredity upon the shape of the teeth and general arrangement in the arches is not difficult to trace; but the line is very indistinct which separates the inherited from the acquired influences which operate in the disproportionate development of the maxilla and the mandible as expressed in the protrusion of one jaw and the retrusion of the other. The causes of supra-occlusion, infra-occlusion, and of torsion are also indefinite. There is a difference of opinion among members of the profession—among orthodontists in particular—as to the cause of certain facial deformities that are dependent upon the size or the position of one dental arch to the other. Upon the determination of the exact causes of all facial deformities that are in any way related to malocclusion of the teeth will depend the success or the failure of the orthodontist. These causes must be determined in accordance with the rules of normal occlusion and facial harmony. I would therefore suggest that a competent committee be appointed by this congress to tabulate the causes of facial deformity as related to malocclusion of the teeth.

Prevention. It is not enough for the modern physician to treat only the symptoms of a disease; he must know the cause and remove it if possible, to prevent spreading or recurrence. The highest ideal in medicine is the prevention of disease; in dentistry, the prevention of decay of the teeth and of all diseases of the oral cavity; so the highest ideal of the orthodontist should be to prevent malocclusion and facial deformity. To prevent, we must know the cause. Dentists are the instructors of the people in the care of teeth; and so every graduate in dentistry should acquire a knowledge of the fundamental causes of malocclusion as known to the profession, in order that he may instruct his patients and may so operate as to cause the least deformity. If a college does not instruct pupils with this end in view, it fails in its duty to prepare graduates for a work which the people have a right to expect from this honored and scientific profession.

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* Angle, "Treatment of Malocclusion of the Teeth and Fractures of the Maxillæ."

SECTION VI—Continued.

SECOND DAY—Tuesday, August 30th.

The chairman, Dr. Angle, called the meeting to order at 2.30 P.M. and Mr. EDMUND H. WUERPEL of St. Louis, Mo., delivered a lecture entitled "Art as Applied to Orthodontia."

The address was as follows:

Art as Applied to Orthodontia.

By Mr. EDMUND H. WUERPEL, St. Louis, Mo.

It is with much diffidence that I approach the subject assigned to me, for it is almost impossible to collect in one lecture all the data that should be given to properly present the subject to you.

The application of the principles of art to the subject of dentistry may seem to the average layman a field too widely separated to allow of special treatment; but I have found to my great delight that the principles of art are more or less directly connected with very many of the trades and almost all of the professions. In some instances these applications are very much more obvious at first glance than in others; but it ought not to take a thinking mind very long to trace the relation between dental science and the art of beautifying the human countenance.

In prehistoric times, when the races of mankind were fewer and national traits of character less complicated, the possibilities of placing art on a purely scientific basis might have been considered. For instance, taste, that tremendous factor in the appreciation and understanding of the beautiful, was a very simple matter. Indeed, from the records preserved for us we find that art in the stone, iron, flint, and other ages *did* follow certain fixed rules, laws, and standards. The human race was less complex then than now, and that which pleased one was not unlikely to please the multitude. So the decorator could apply certain preconceived laws which were very apt to meet with universal approval. Then, too, his types were, from force of circumstances, very much akin, for we find in the lower development of the human race very much the same characteristics which we find in the lower order of animals—more or less a fixed

type. So if an artist caught, no matter in how crude a form, the racial characteristics, he found that a single type of head and figure would suffice for the entire race. Therefore it is not unlikely that he created for himself and his successors certain rules and standards by which he allowed himself to be guided. We see this in certain types of the Peruvian, Aztec, and Indian tribes, and we see it still more marked in nations of a much higher standard of civilization—the Assyrians, the Phœnicians, the Egyptians, and the Greeks.

How much the traditions of past ages had to do with establishing the standard of the higher types of peoples it is difficult to state. But even in the races mentioned it is not unlikely that standards or fixed rules were adopted because the types of men and women lent themselves to rules. Thus the Assyrians used an almost universal method of dressing the hair and the person in each of the different classes of the population. These differences were strongly and clearly marked and were invariably the same, so that for a certain class of Assyrians a certain distinctive type was accepted. This led to the adoption of laws which evolved standards.

So it was in the case of the Egyptians. To those who have studied the Egyptian hieroglyphics there is no trouble at all to distinguish between royalty, nobility, freeman, and slave. The standards were absolute and all artists had to conform to them.

In the case of the Greeks there was increased freedom with increased mental development, and although we see an absolute casting aside of conventionalities in regard to movements, drapery, and composition, we still feel a fixed type in the faces and figures. This may be attributed to the fact that the Greeks glorified their gods in their art, and naturally the tendency was to create types in the different gods and goddesses; thus we have the Juno, the Venus, the Mars, the Jupiter, and many other types. Not only the gods but the demigods and all mythological characters were given certain typical standards; so, knowing the laws governing the cases, we have no difficulty in recognizing a Diana, a Bacchus, a Bacchante, a Hercules, or a Hebe.

Thus it was easy for the Greeks, and the Romans who followed them, to establish certain set standards not only for the figure but for the head as well. These standards were admirably adapted to the people who created them, but it is not possible for a twentieth-century individual to adapt himself or herself to the Greek or Roman standard. Our lives are different, our individuality is a thousandfold more marked; with individuality come ruling passions, which to a great degree mark the facial development of man. Thus it is that we exclaim in a crowd, "See that man yonder; he looks like a lawyer, or a doctor, or a banker. That woman must be an actress, a singer, a clerk, or a bookkeeper," meaning that people in certain fields of life develop certain traits of character, are actuated by similar motives, and develop, in consequence, certain typical lines of face and very often of figure. The wrinkles in a man's face often betray the manner of his thought, and this universality of thought in given fields has made it possible to produce those interesting studies or experiments in composite photography which were so much talked of some years ago. Now this is just exactly what the Greeks did; without the aid of the camera they created composite types, and really adapted them admirably to the

subject they happened to have in hand. But it would require endless research and time to even begin to typify the modern civilized races of man. The complexities are too great, the fields too diversified and scattered, to allow even a thought of classification and arrangement in any but the broadest manner.

Even so long ago as the Spanish renaissance we find that men have tried to typify certain subjects. This was made possible by the Spanish inquisitors in the case of religious paintings. The church became the chief patron of art; not only was it the chief patron, but the chief producer as well. The painters themselves came from among the priests and monks, and it became a comparatively easy matter to establish fixed rules to govern them in the production of their works of art, and we read nowadays with certain smiles of superiority the rules established by Pacheco, that famous father-in-law of the more famous painter Velasquez. We read of such things as follow: "The Infant must always be decently clad and must be covered, because St. Joseph had ever been sufficiently well off to pay for necessary garments." The arrangements of the drawing, the composition and the color in each of the various representations of the Virgin were strictly set down, and heavy fines and penances were exacted from all painters who did not conform to these rules. In this case, too, we can easily understand the possibility of such universality of treatment, for the people were narrow and ignorant to an extreme degree. The church was most powerful, and all laws governing the people emanated from the church. But even this uncivilized condition did not last long. The people might have submitted to the exactions of the church for a longer period of time, but the artists themselves rebelled. The king of Spain, Philip IV, was forming his great collection afterward known as the "Prado," and for this purpose drew largely from all the galleries of Europe. Not only pictures, but artists from all countries came to the court of Andalusia. Spanish painters under the patronage of Philip cast aside little by little the restraining influences of the church, and during the time of Goya not a single vestige of the rules of Pacheco were to be found in the art of Spain.

This was the last attempt ever made to create fixed laws and rules for art—to create arbitrary standards; and we of to-day, in the face of complex and constantly changing conditions cannot possibly see the way open to fix rules of any kind. Even the laws of composition which during the great renaissance period were universal throughout all the civilized regions of Europe are today cast aside to be used only when the convenience or lack of originality of the artist require them.

The outgrowth of civilization seems to be to create a law for each individual, and that law is governed by the temperament of that individual. It is so in business, it is so in education, it is so in the private life of the family, and it is so in art. We can no longer say that certain laws must govern all students. It is being questioned in many of the advanced institutions of learning whether the methods of examination which for so many years, we might almost say centuries, have been employed to determine the mental status of the student are not based on a false principle. Human beings have risen above the grade of cattle. They can no longer be driven in herds, as atoms in a great unit. They are units

in themselves, and any attempt to treat them otherwise results in utter eonfusion. So all rules governing sueh a eondition of the human raee must be applied with great forethought and prudence. We must not only eonsider raeial eharaeteristies, but in addition we must eonsider the individual, and above all the partieular type to whieh a person belongs. It may beeome more evident what this means when you see some of the types whieh will be presented to you on the sereen. You will agree with me that no speeial rules can be applied to any of them; that it is a question of balanee, of symmetry; that only the laws of reason ean be applied—and reason means a great deal of eommon sense, and ability to put it into praetiee. So we will eonsider this matter with the aid of the slides whieh are to follow.

[The light was then turned off and a lantern exhibit given, showing the early Assyrian, Egyptian, and other types of art as shown in the monuments, memorial struetures, and other edifices erected by these ancient peoples; also showing the types of peoples as evolved by their mode of life and environment, soeially and politieally.]

Before elosing his address Mr. Wuerpel showed on the sereen a number of eases of irregularities of the teeth, showing them before and after treatment; and in speaking of the best way of eorreeting the irregularities so as to produee the best results he said that no rule eould be laid down—that it is simply a question of balanee, and that any eorreetion must be made with a view of maintaining the balanee of all of the other features, likening the irregularities to dishes on a tray whieh were unbalaneed and whieh needed to be adjusted in order to retain their places without being displaeed or displacing others.

The CHAIRMAN. We have listened to a most valuable and interesting lecture on a subjeet second only to oeelusion itself. The subjeet is now open for discussion and we shall be glad to hear from anyone, if only in the form of questions.

Dr. M. T. WATSON spoke in the highest praise of Mr. Wuerpel's leeture, and moved a standing vote of thanks to the essayist, which was given unanimously.

The CHAIRMAN. Before passing this paper I wish to say that those of you who have kept in toueh with the modern literature of orthodontia know that the best of it has emanated from the members of the American Society of Orthodontists. You will also remember that no small amount of this literature has had a bearing on facial art. Now the fact is, the real mainspring behind all this—the molder and fashioner of those thoughts relating to art—has been the gentleman to whom we have all had the pleasure of listening this afternoon. Our inspiration has come from him, and nearly all we know of art he has taught us, and we all feel very greatly indebted to him.

Discussion.

Dr. S. E. DODSON, Grand Rapids, Mieh. I would like to ask what is the relation of the upper and lower lip in the two types, the Greek and the Roman, as to prominenee. In the Greek type does the upper lip have a more prominent aspect, and in the Roman the lower?

Mr. WUERPEL. It depends on the state of balance. You have to study the faee.

I purposely made that point of the tray with the plates on it to show that you must try to feel what part is being shoved out and what is not.

Dr. DODSON. I speak of ideal types.

Mr. WUERPEL. In both the Roman and the Greek the upper lip should slightly protrude over the under.

The CHAIRMAN. The next paper is by Dr. WM. SLOCUM DAVENPORT, of Paris, France, "Correction and Prevention of Malocclusion by the Bite Guide and Other Methods." It will be read by his brother, Dr. I. B. Davenport, Paris, France, the writer not being present.

The paper was as follows:

Correction and Prevention of Malocclusion by the Bite Guide and Other Methods.

By Dr. WILLIAM S. DAVENPORT, Paris, France.

A THOROUGH knowledge of the intricate factors involved in the dental articulation is the foundation on which all questions of orthodontia are being solved.

For the first time in the history of dentistry there seems to be some unity of idea in the treatment of cases requiring regulation. Many are donating their ideas, inventions, and methods to the common cause, all of which are being classified and compiled by a certain few. Extremists are becoming broader in their views, and all are more anxious to accept the good, and to give credit where credit is due.

Years ago, Dr. Norman W. Kingsley published his method of using an appliance, involving the inclined plane, for "jumping the bite." Since then, Drs. Angle, McBride, and others have introduced methods of retaining the lower arch forward, in cases of this class, by cementing fixtures to the teeth.

The "bite guide" I have the honor of presenting is a modification of the Kingsley plate. It is an inclined plane of gold, soldered to bands which are afterward cemented to the upper incisors, especially the two centrals. The lower incisors strike against this plane with a sliding motion, and the whole lower arch is guided forward to the position desired. It will be of interest to the profession to know that, when my paper was prepared for the press, I first learned, through the July number of the *International Dental Journal*, page 492, that Dr. Ainsworth had been working on the same lines, and had presented the bite guide, or what he terms "inclined plane for jumping the bite and adjusting the articulation," before the New York Institute of Stomatology, on May 1, 1904. This is of interest, and it only confirms my statement that many of us are working on the same lines and for the common cause.

My first use of the bite guide was in November 1902. Soon after that I presented my first case before the American Dental Club of Paris, and it has been used since by a number of my colleagues in Paris. In this word of explanation I am not trying to establish priority of treatment, or usurp any honor belonging

to Dr. Ainsworth, and I feel sure it matters as little to one as to the other who was the first to cement the "Kingsley inclined plane for jumping the bite" to the teeth.

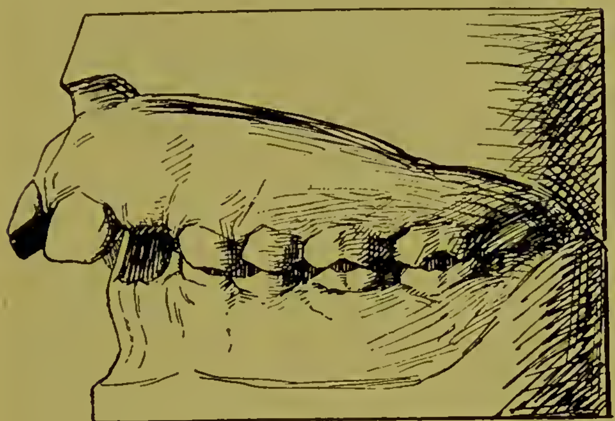
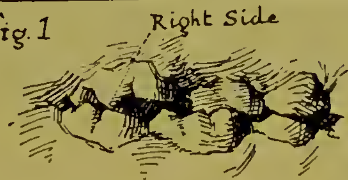


Fig. 1



The great advantage of the bite guide is that it can be applied at an early age, when the eruption of the teeth and the growth of the maxilla and mandible are easily influenced, and can be used to prevent as well as to correct deformities.

The bite guide is an effective retainer and can be worn indefinitely without injury to the teeth, and it will be seen by the following cases that it may be used in connection with various jump-bite, spreading, and retracting appliances. In the greater proportion of irregularities

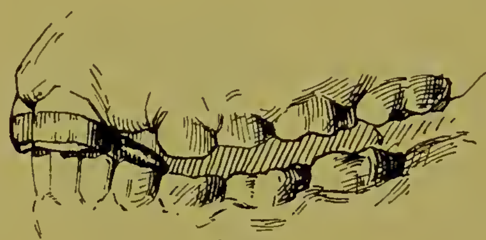


Fig 2

Fig 3

there is an abnormal curve of the dental arch, and an excessive overshutting of the front teeth. The bite guide plays an important rôle in such cases, as it re-

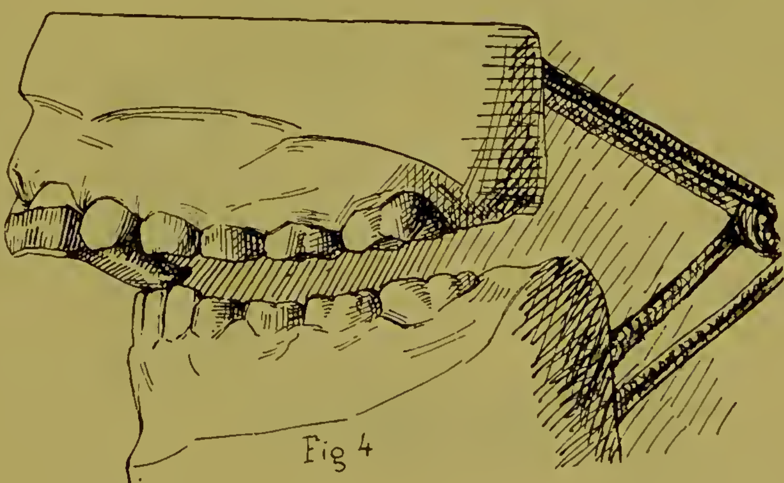


Fig 4

lieves pressure from the back teeth and brings force to bear on the front teeth, which helps to establish the normal curves of the arches. It also tends to draw the upper teeth backward and pre-

vents the elongation of the front teeth, which is apt to occur when using the "intermaxillary elastics" as an aid in jumping the bite or elongating the back teeth. I take the liberty of adopting Dr. Angle's valuable classification in the following cases.

CASES.

Case I. (This case comes under the head of class 2, 1st division.) An American girl eight years of age. Her brother has the same deformity. Nose and throat are in healthy condition. In the treatment of this case the centrals were rotated into line by means of a silk ligature; the bite guide was made and cemented to the centrals.

Fig. 1 shows the case before treatment. Fig. 2 shows the general relation of the teeth with the bite guide in place. Fig. 3 shows the condition of the teeth after four months' use of the fixture. Fig. 4 shows the awkward position of the teeth when the patient attempts to bite in the original position. Fig. 5 is a photograph of the patient before and after treatment. The teeth took forward position at once, and the patient experienced no difficulties. The fixture will be kept in place until the bicuspids erupt and all the teeth articulate.

Fig. 5

Case II. (Class 2, 1st division.) Spanish-American girl, nine years of age; a mouth-breather; had tonsils removed at her sixth year. The only case in the family.

Fig 6

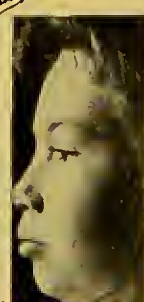


Fig 8

Fig 7

Fig. 6 shows the case before treatment. Fig. 7 shows the condition after the use

of the bite guide for six months, no attention being required in the meantime. Fig. 8 shows a photograph of the patient before treatment.

Fig 9

Fig. 11

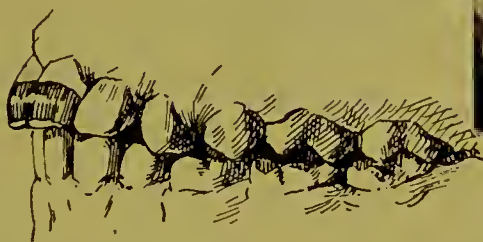


Fig 10

The patient will continue with the fixture applied until the bicuspids are well in place. The lower arch may require some attention later on.

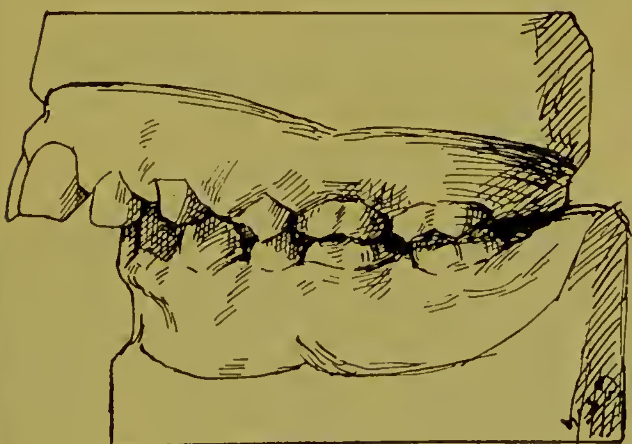


Fig 12

Case III. (Is developing into class 2, 1st division.) A French boy nine years of age, suffering from enlarged tonsils; treated several times with electric cautery; a mouth-breather. The mother of the boy presents a similar condition of the teeth.

Fig. 9 shows the condition of the teeth before treatment. Fig. 10 shows the condition after six months' use of the bite guide.

The patient will continue with the fixture applied until the bicuspids are well

Fig 13

in place. A photograph of the face (Fig. 11) shows slight protrusion of the upper lip and receding lower jaw.

Case IV. (Class 2, 1st division.) A

Greek girl of twelve years. The throat and nose in healthy condition. The patient has in an exaggerated way a deformity similar to that of her mother, and the habit of biting the inside of the upper lip.

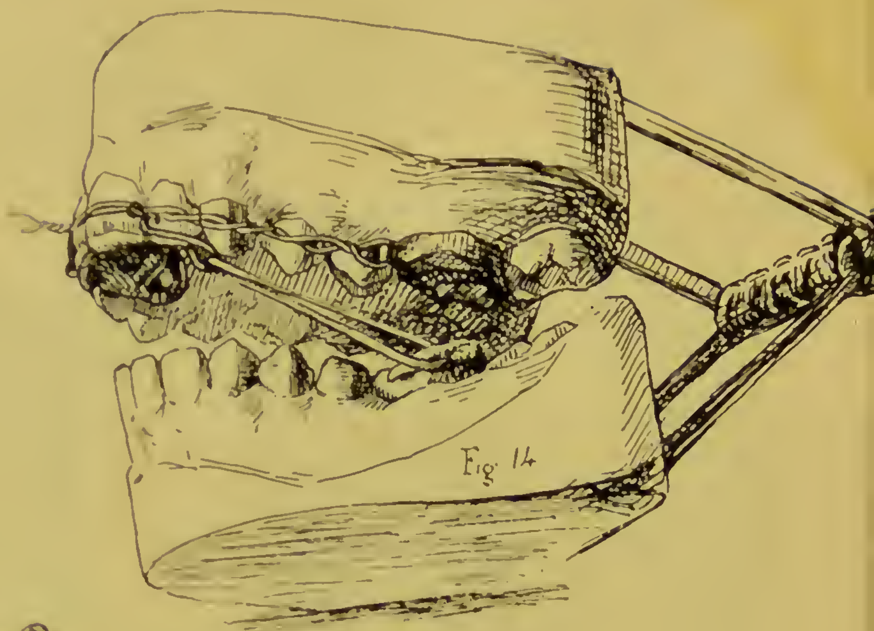


Fig 14

Fig. 12 shows the case before treatment. Fig. 13 shows the condition after treatment. Fig. 14 illustrates the bite guide in position working jointly with a retractor of twisted wire. The "intermaxillary elastic" on the left side is used to correct the deviation from the median line, and at the same time to draw the left lower molar into proper position.

Fig. 15 shows two positions of the bite guide; also two gold caps

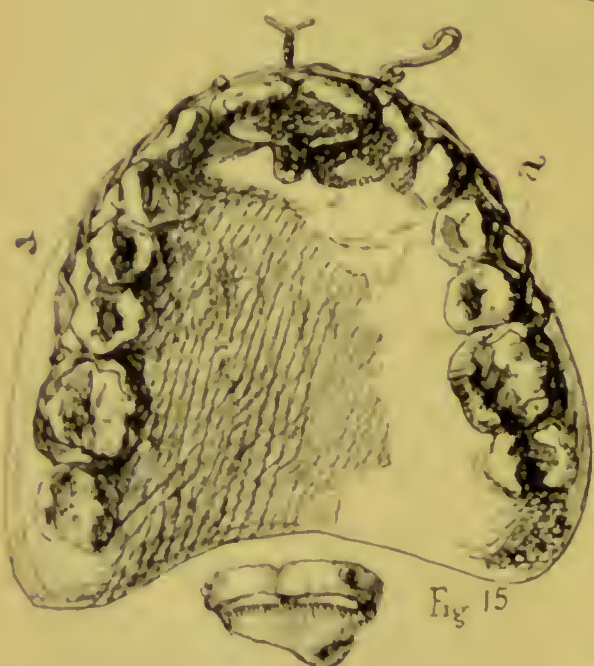


Fig 15

—all of which have gold loops soldered to them through which the twisted wire retractor is applied. Note the nature of the twist in the wire, also openings (*a, a*) through which an instrument may be passed for twisting the wires, which applies force.

Fig. 16 shows photographs before and after treatment. The treatment of this case has extended over eighteen months, and it will require constant watching

Fig 16

and night retention with a plate, as the tendency is for the upper front teeth to move forward. The teeth are small and pointed, thus making it diffi-cut to establish the "interlocking ar-

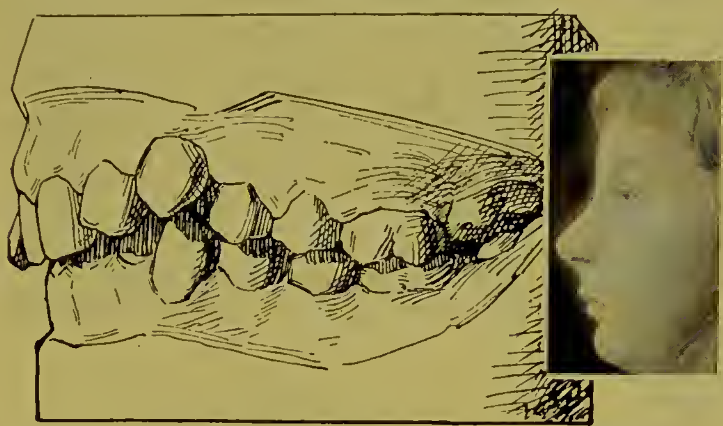


Fig. 17.

ticulation" that is so necessary for self-retention.

Case V. (Class 2, 2d division.) A

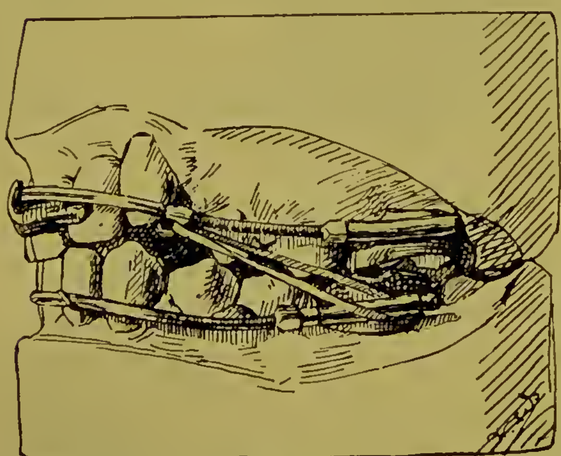


Fig. 18.

Russian girl, twelve years of age. At the eighth year the tonsils were removed, and polypi at the twelfth year.

Fig. 17 shows a photograph of the face, also the condition of the teeth before treatment. Figs. 18 and 19 illustrate the use of the bite guide in combination with various established methods. A hook is soldered at the front of the bite guide, against which screw pressure from the Angle "expansion arch E" is brought to bear in such a manner as to draw all the front teeth forward; and at the same time both arches are expanded. The lower and back teeth were elongated, the abnormal curve corrected, and the mandible jumped forward by means of the intermaxillary elastics.

The bite guide relieves pressure on the back teeth, thus making it easier to draw the teeth upward, and at the same time prevents the elongation of the front teeth during the constant application of the intermaxillary elastics.

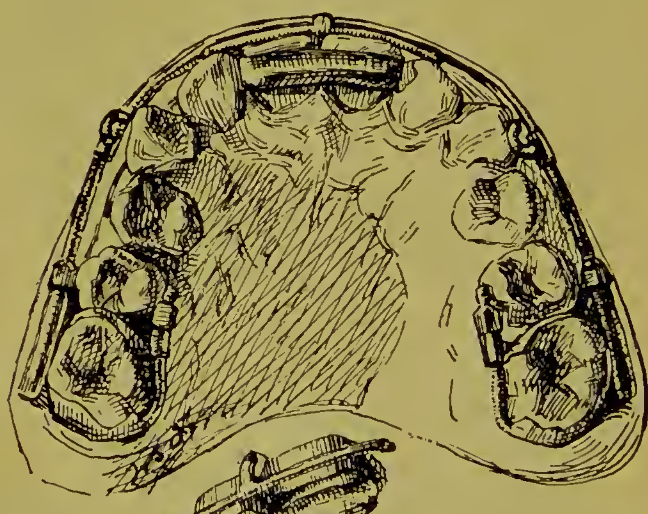


Fig. 19.

Case VI. (Class 2, 1st division.) A French girl, twelve years of age. The mother has the same irregularity, though less marked.

Fig. 20 shows the case before treatment. Fig. 21 shows the case after two years' treatment to be still under class 2,

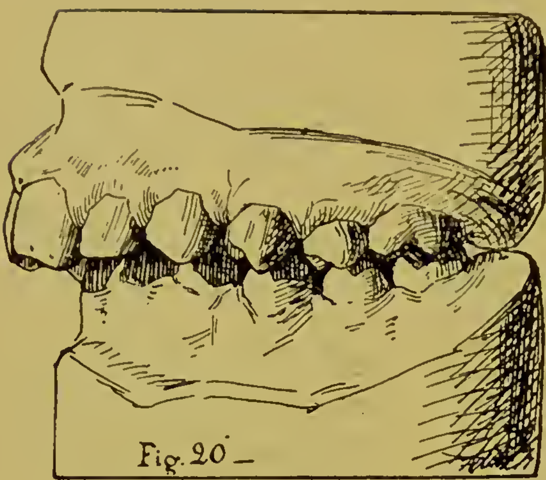


Fig. 20

Fig. 22

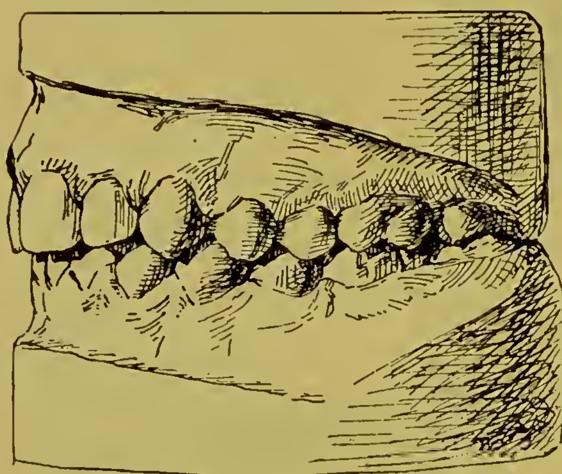


Fig. 21

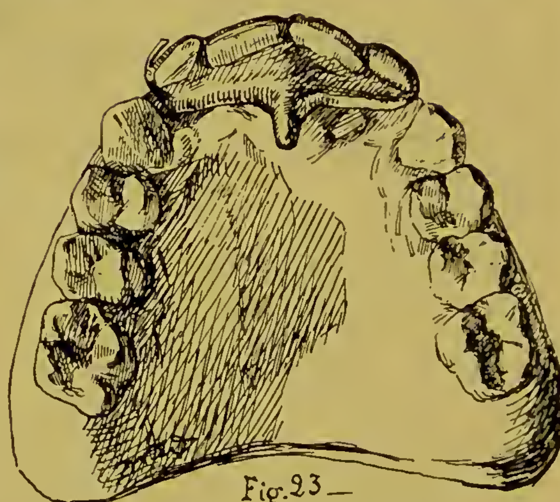


Fig. 23

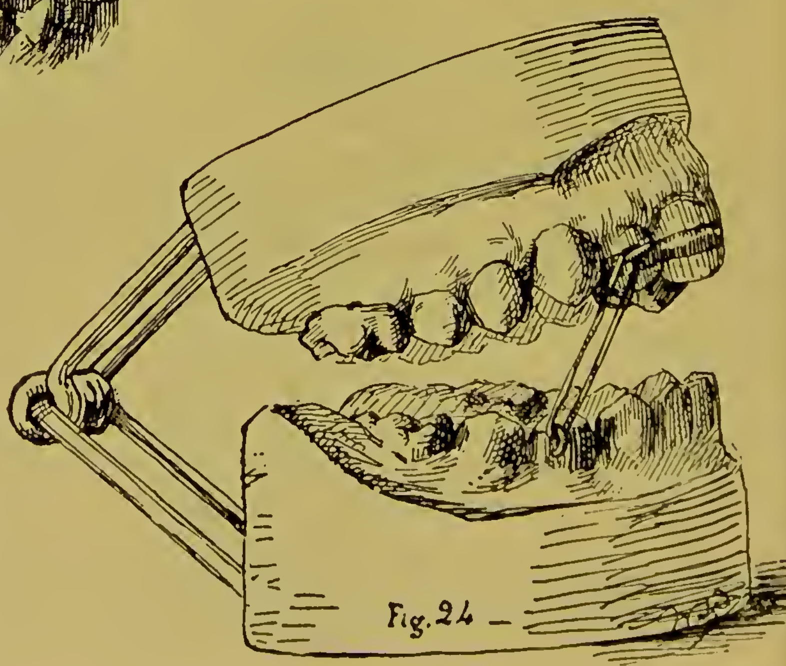


Fig. 24

subdivision of 1st division—that is, the right lateral half only is in distal occlusion.

Fig. 22 shows photographs of the face before and after treatment. Note flat upper lip of the second picture; the failure to obtain perfect results in this case is due to bad diagnosis and also faulty use of appliances. First, I

made an error in considering this case one of anterior protrusion. Secondly, in drawing the upper front teeth backward, when they should all have been moved forward. Thirdly, in applying the bite guide to the teeth while still in an irregular position. (See Fig. 23.) Fourthly, in attempting to jump the mandible forward when there was no room for the teeth owing to the irregularity of the front teeth and the general crowded condition. Fig. 24 illustrates an impossible attempt to better this unfortunate condition.

When should we begin the treatment of similar cases? I believe that Dr. Bogue—one of the great advocates of early treatment—advises beginning as soon as the permanent first molars are sufficiently developed to hold an appliance. In 1897, Dr. I. B. Davenport presented before the American Dental Club of Paris the case of his son (class 1) when he began treatment, by using plates, before the child was three years old. As will be seen by the foregoing cases, I have begun treatment as soon as the centrals were well in place.

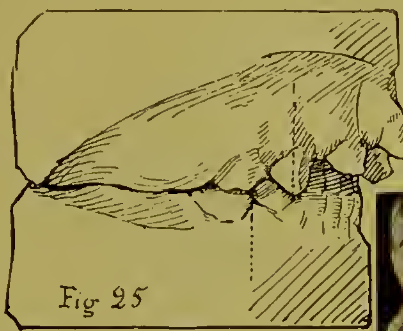


Fig. 25

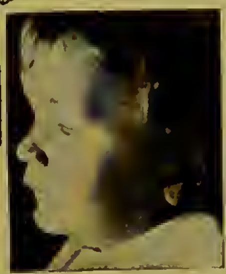


Fig. 28

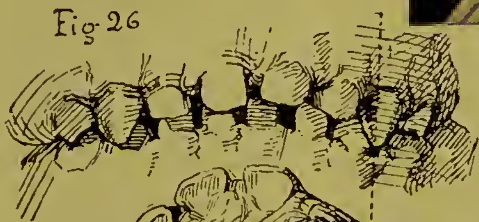


Fig. 26


Fig. 27

There is no doubt in my mind that in the near future orthodontia will develop, like other branches of dentistry, into preventive rather than curative methods. We have all observed the susceptibility of the teeth and jaws at an early age, and how diseased organs and bad habits soon play havoc with the harmony of the dental arches.

With these important facts in view, it is our duty as a profession to instruct parents what a normal condition is, and to bring their children to us as soon as they have teeth. We shall then be able

to see if irregularities are forming, and to advise in regard to abnormal conditions of adjacent organs, or warn against bad habits which might prove detrimental. I remember as a small boy, on the advice of my brother, having rotated two very irregular centrals into line by constantly applying force to the teeth with my fingers. Working along this line, I believe that much can be accomplished in preventing the development of deformities if proper treatment and attention be given in time.

Case VII. (Class 2, subdivision of 1st division.) An Amerian boy, two years of age. First case recorded in the family. Breathing and throat normal.

Figs. 25 and 27 show the retracted condition of the mandible on the right side, while Fig. 26 illustrates the normal occlusion of the teeth on the left side. Fig. 28 is a photograph of the patient before treatment. I have explained to the parents and nurse of the child the faulty conditions existing, and have advised them to model the child's teeth into a normal condition. They are instructed to use finger force several times daily in the region of the upper right canine, as well as all the lower front teeth, pressing all the teeth outward.

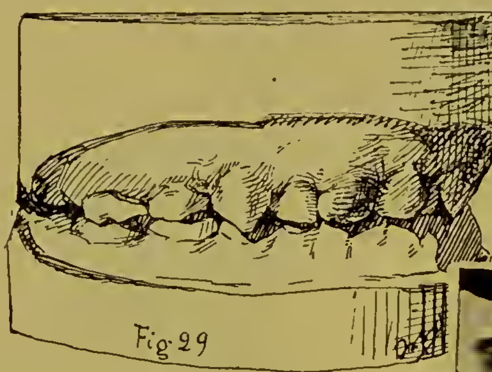


Fig. 29

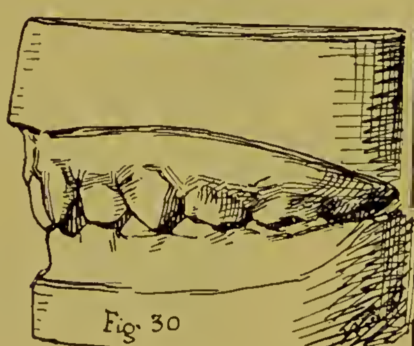


Fig. 30

Case VIII. An American child, two-and-a-half years of age. This case is developing into class 2, 2d division. The child has large tonsils but breathes normally.

Figs. 29 and 30 show the excessive overshutting of the front teeth and the faulty articulation of all the teeth. The patient, being my child, is undergoing

a systematic finger-pressure treatment. The front teeth and alveoli are being pressed forward several times a day. The child is amused by the treatment, and I hope to be able to improve the present condition so that when the first molars erupt they will be able to take their proper positions.

Discussion.

Dr. L. S. Lourie, Chicago, Ill. The essayist wishes to present three points for our consideration, the first being the appliance which is termed the bite guide, the second a retractor of twisted wire for retracting incisors, and the third a recommendation for the employment of finger pressure for early establishment of teeth in position in younger persons.

From the presentation of the cases it is apparent to me that the appliance presented here, which the essayist states was elsewhere presented by Dr. Ainsworth, is applicable to only a small variety of cases.

The essayist says that the arch must be straightened first—must be placed in proper "arch relation" before the bite is jumped. Since this is necessary, it seems to me that the bite might be jumped at the same time that the arches are being expanded and the occlusal plane of the arches restored. The first three cases show conclusively that this appliance is effective in these cases. The time required ranges from six to eight months to a year and a half. I think the appliance must be very uncomfortable to the patient, and even though the patient become accustomed to it, the interference with speech must be material. An appliance of this kind may be used effectively as an aid in truing up the occlusal plane of the arch before the bite has been jumped; but I gather from some remarks the essayist has made that he does not thoroughly understand the use of the intermaxillary rubber ligature. In one of the cases illustrated (Case V) the expansion arch is used and supported upon the bite guide plate upon the labial side. This is to "prevent the elongation of the incisors which would otherwise naturally take place." Now if the expansion arch were placed below this spur it would operate much more effectively.

The retracting appliance shown in connection with Case IV is, I think, a very unscientific appliance, and I am surprised that it should be brought forward at this stage of development in simple and effective appliances for the treatment of malocclusion. In most of the cases where the anterior teeth are to be retracted some provision must be made to provide room for them; the arch must be expanded laterally. This appliance, which is simply a wire ligature passed from the molars around the anterior part of the arch and then twisted to retract the incisors, makes no provision for the lateral expansion of the arch, and consequently cannot be very effective in retracting incisors. The anchorage is not sufficiently stable. A retractor that is simply attached by means of a wire ligature is apt to move the molar forward in retracting anterior teeth; a simple anchorage is used where a stationary anchorage should be employed.

The third point which the essayist wishes to bring out is the necessity for finger manipulation of the teeth in very young patients in order to prevent irregularities or to correct simple cases which are just beginning. He cites two

cases in which he has just begun such treatment, but he does not show any results. We all know that finger pressure upon the incisors has been a common practice for a good many years; many present may have tried it. Possibly some have met with good results, but the essayist does not report any results; he simply shows the two cases. I cannot quite see in what way the cases shown may be of special benefit to us. In one case—the subdivision of class II according to the Angle classification—in which there is unilateral distal occlusion, efforts were made to correct the malocclusion by applying force to the incisors or canine on one side, to push distally one entire half of the upper arch I think it is not probable that finger pressure will remedy the defect. To restore the normal position of the teeth by finger pressure is necessarily a very slow process. I think it is advisable to put on an appliance, a simple one, that will be effective in a short time, the patient using the teeth as nature intended they should be used. I believe that would be more effective in preventing malocclusion or correcting a slight malocclusion that already exists.

In conclusion I desire to say that the essayist is to be complimented on the results he has obtained with the bite guide in younger patients.

Dr. H. A. Pullen, Buffalo, N. Y. My first acquaintance with the casts exhibited by Dr. Davenport was made a few moments ago, and the cases shown do not prove conclusively to my mind that the essayist has as well performed the operation of jumping the bite as we do with simpler appliances. It seems to me that he has arrived at a part of the truth, but that he has worked with a greater number of appliances than necessary. We can jump the bite with simpler appliances. I think the jump-bite appliance might better be used as a retainer than as an appliance for doing the operation. I have little faith in an inclined plane for performing these severe operations in orthodontia. I think we need a greater amount of anchorage, a firmer and more stationary anchorage, and I think we have a greater range of operations to accomplish than would seem to be called for by the use of this one appliance. As Dr. Lourie said, the change of the shape of the arch in the movement of individual teeth cannot be done with the jump-bite appliance as illustrated by the essayist.

Regarding finger pressure, I do not think it accomplishes much. I have had many cases where doctors advised it, and nurses have tried to accomplish it, but it did not amount to much. I think a dentist working on his own child might appreciate the results obtainable by finger pressure. The only case I know where it did any good was in the case of a young man working in the dental office. He had a wooden cigar which he held between the teeth to force out an upper central incisor, which he finally accomplished after months by holding it between the teeth and forcing it downward against the lower arch as a fulcrum.

The Chairman. We have with us a number of foreign friends and we will be glad to hear from them.

Dr. K. A. Davenport, London, Eng. Perhaps I should apologize for speaking on the paper at the present time, but it seems to me as though a wrong impression has been taken, because of the paper not being properly illustrated. The essential points have been missed. I have been using this appliance for a year or a year

and a half, and at the present moment have some eight or ten cases under way. The essayist I think intended to convey the idea of using this appliance at an early stage, and in that respect my practice has been to put it on as soon as I have found the malposition of the first molar established, before the bicuspids appear in place at all. In some of my cases the bicuspids are beginning to come, and I find that the jaw takes position, the first molar becoming normal in a very short time, and the bicuspids will fall in line; that is, good normal occlusion.

Dr. Lourie speaks of the discomfort in connection with this appliance. He speaks of it as being a complicated appliance. I don't know what he means by that. Certainly two bands on the incisors with an extension is not a complicated appliance. It is not more complicated than bands in other positions. My practice has been to use this appliance very much as my brother has described it, and after forty-eight hours, in children from seven to ten years of age, I have never had any complaint as to discomfort.

For a girl of twelve, I found it necessary to increase the anchorage, which I did by banding the canines as well as the centrals. The lower incisors and canines were made to take a normal position through contact with the bite guide. In a few weeks the excessive curves in the lower arch had disappeared, the incisors having shortened and the bicuspids and molars elongated, thus producing an excellent locked bite. I have kept it in place as a retainer, and after six months find it impossible for the child to bite back.

There are certain cases where I have found this appliance especially useful, viz, where the teeth are seemingly too small for the arch, in children who are not well nourished. Through the bite being opened the teeth are allowed to move forward, which closes these objectionable spaces and overcomes that weak expression which is so difficult to master with other appliances. They go on for several months and patients are able to go away for six months at a time after the first few weeks and I can feel that they are perfectly safe.

The CHAIRMAN. I would like to ask the doctor if he would apply that sort of appliance to a patient eighteen or twenty years of age if the case was well pronounced, or whether with a young patient he would be able to correct with that method alone a well-established typical case belonging to that category?

Dr. DAVENPORT. In pronounced cases with contracted arches I would make use of other appliances; personally I should employ other appliances, but I look upon this method as one of prevention; in many cases its employment would obviate the necessity for further treatment.

A MEMBER. I would like to ask how the essayist induces the patient to wear the appliance of twisted wire. It seems to me that it would be an exceedingly unpleasant one to have in the mouth.

Dr. I. B. DAVENPORT (closing the discussion). The purpose of the paper is to show that this appliance, while effective in itself, is not an apparatus to be used exclusively; its use may, however, be supplemented by others, or other forms of appliance may be employed.

In regard to twisted wire, the patients have not objected to twisted wire more than to ordinary bands. There is no difficulty in that respect.

The CHAIRMAN. The next paper on the program is by Dr. CALVIN S. CASE of Chicago, Ill., and is entitled "Principles and Technic of Retention in Orthodontia."

The paper was as follows:

Principles and Technics of Retention in Orthodontia.

By CALVIN S. CASE, D.D.S., M.D., Chicago, Ill.

PRINCIPLES OF RETENTION IN ORTHODONTIA.

IN the application of modern methods for the correction of malposed teeth considerable satisfaction is experienced by the dentist in his ability to move the teeth to the desired positions and attitudes. But when it comes to that branch of the operation which pertains to the permanent retention of corrected teeth for future use and beauty, it is quite often a very different story; and so when you see or hear expressed the opinion that this important and indispensable branch of the operation of regulating teeth can always be easily and surely accomplished with very simple appliances, or that it is one which does not at times demand the highest order of skill and judgment, or "that teeth regulated according to the principles of normal occlusion, without extraction, never fail in permanence of retention whatever the cause of irregularity," you will not be far wrong if you conclude that the orator is a man of either limited experience or one given to delusive expressions. These opinions may be partly due to the fact that most teachers of orthodontia treat this branch far more lightly and inadequately than it deserves.

In my opinion it is so far-reaching in detail of conditions and methods as to make it impossible in a single society paper to mention more than the most salient features which practically relate to the underlying principles of the art. These may be divided into: (1) Influences of inheritance. (2) Influences of physical relations before and after correction. (3) Principles of retaining appliances and the technics of construction and application.

INFLUENCE OF INHERITANCE. The inheritance of any family type of irregularity, from that of a single malturned incisor to excessive protrusions and retrusions, will be found difficult and in some instances impossible to retain in corrected positions without a permanently attached fixture.

The longer I practice orthodontia, the more respect I have for the general teachings enunciated twenty-five years ago and more, and published in that inestimable work entitled "Oral Deformities," by our grand old man of orthodontia, Norman W. Kingsley. While the implements and appliances used for retention in those days were very crude as compared to those of the present time, the difficulties arising in certain conditions and the influences of natural laws remain the same, and continue to engage our most earnest endeavors and often

futile attempts at permanence of retention, even with the most perfectly constructed modern appliances. Dr. Kingsley expressed thousands of ideas that are as true and applicable today as when first written. Indeed, we continually see in print these and many time-worn important thoughts re-clothed and presented in a new and forceful light, and I am sorry to say, too often introduced and claimed as discoveries of modern origin. He sums up in the following words all that I would care to say relative to the influences of inheritance:

"In hereditary cases of extensive character which have been delayed until at or near maturity, we can never feel certain that the original tendency to malposition so long unbroken will not re-assert itself at any time that we abandon retaining fixtures."

PHYSICAL RELATIONS. In regard to the second phase of my subject, *i.e.* the influences of physical relations before and after regulation, I cannot do better than quote Dr. Kingsley at some length:

"The occlusion of the teeth is a most potent factor in determining the stability in a new position.

"If occlusion of the teeth will be such as to favor the retention of moved teeth in their new position, then considerable movement may be attempted at almost any age at which it might be desired, and with an expectation of success; but if, on the other hand, the occlusion would be bad, with a tendency to drive them to their former positions, then all efforts at regulating would be folly at any age.

"Teeth could only be retained in changed positions under such circumstances by constantly wearing fixtures which would jeopardize their durability and permanence. The wearing of retaining plates as well as all other fixtures upon the teeth is undesirable and objectionable; they are an evil, necessary in some cases, but to be avoided as much as possible. Nevertheless, the fruits of a skilful and successful effort in regulating teeth must not be lost by neglecting to retain them in place until they not only become firm, but the tendency to return to their former positions has been seemingly overcome."

Dr. Edward H. Angle, in his work entitled "Malocclusion of the Teeth and Fractures of the Maxillæ," has also expressed many valuable thoughts relative to the principles of retention, which are worthy the careful study of all who essay the regulation of teeth. A small part of this teaching is as follows:

"It should ever be borne in mind that unless the conditions which have been operative in producing or maintaining malocclusion be removed or modified, the establishing of permanent normal occlusion can rarely be hoped for. For example, if the arches have been narrowed and the teeth forced to take malpositions as a result of mouth-breathing due to pathological conditions of the nasal passages, it will be very improbable that the teeth remain in correct occlusion after removal of the retaining device, regardless of the time it may have been worn, unless normal breathing be established, so that the mouth may be closed and the teeth not deprived of occlusion and the normal restraint and support of the lips, the requisite amount of time.

"Again, if irregularities of the upper teeth have followed as a result of the diminished size of the lower arch, from an overlapped or irregular condition of the lower teeth, it would be folly to expect the teeth of the upper arch to be per-

manently maintained in their new positions unless occlusion be established by harmonizing the proportionate sizes of the arches by correction of the positions of the lower teeth."

I would add to this paragraph another too frequent and deplorable cause of a diminution in the size of an arch that would otherwise be harmonious in its mature relations, *i.e.* that of injudicious extraction of one or more temporary or permanent teeth with the view of correcting a decided malalignment that is mainly due to the undeveloped size of the jaw, and under the mistaken impression that the teeth will not or cannot be otherwise corrected, or even to facilitate correction that would otherwise involve greater difficulties, time, etc.

One of the greatest harms in this sort of malpractice arises from the fact that a contracted arch, caused by the loss of any of the permanent teeth, that would otherwise be harmonious in its relations will almost invariably produce an irregularity of opposing teeth, which if corrected will be found impossible to retain unless either an equal number of teeth have been extracted to harmonize relations in size and occlusion, or the contracted arch enlarged and supported with an artificial denture.

In the discussion of a paper which I presented at the last meeting of The Institute of Dental Pedagogics, and published in the July *Items of Interest,* I expressed the following relative to this subject:

"In the correction of all irregularities with the view of their permanent retention, occlusion is one of the most important factors for consideration in diagnosis and prognosis.

"In every case where the masticating teeth have established a fixed occluding position with cusps that interlock or interdigitate, whether it be typically normal in its relation or not, any change of that position necessary for the accomplishment of correction should place them in a new occlusal position of self-fixation, else Nature, either in her forceful efforts to perfect the function of mastication, or in response to the laws of inheritance, will mar or wholly destroy the perfect results of treatment, even though the teeth be artificially retained for years.

"In cases where one or more teeth are crowded out of arch alignment, or are malturned or overlapping, if held in that position by the fixed occlusion of other teeth, any movement to accommodate them that is destined to affect the relative positions of the bicuspids or molars will usually require a concomitant movement of the occluding teeth of the opposing jaw."

While a normal occlusion of the teeth is eminently to be desired and striven for in regulation, if for no other reason than the aid it affords to retention, we should not forget that it is somewhat rare to find an anatomically normal occlusion among natural dentures which we even consider regular. But what we do almost invariably find in all cases that are not open-bite occlusions is that the masticating forces have caused the teeth to adjust themselves so that the cusps of one set are fitted into the depressions and sulci of the other with considerable accuracy, showing that this relation, whether by a typically normal occlusion or not, must be attained, else Nature will attain it before she rests; nor can permanence of retention of the masticating teeth be assured before. In other words, a malocclusion is nearly, if not quite, as capable of fixing and retaining the rela-

tive positions of teeth as a normal occlusion when the requisite interdigitation of the cusps has been attained. Then arises the question as to the influence which a possible change in these teeth will exert upon the corrected front teeth toward crowding them forward to their former overlapping or protruded malpositions, or *vice versa;* for, after all, the principal object of the work is to secure a permanent esthetic relation of the front teeth. It is only in rare cases that we can hope to actually improve the masticating function of a fixed occlusion of even quite irregular teeth.

There are many instances of irregularity for which esthetic relations cannot be perfectly attained without extraction; nor can that which it is possible at times to attain without extraction be retained with the same assurance of permanence, because of the forceful tendencies of crowded buccal teeth to assume their former positions.

I refer to excessive protrusion of the upper or lower teeth, with the teeth of the opposing jaw in normal dento-facial relations; also to full protrusions of the upper and lower teeth.

In the cases to which I refer, correction without extraction would mean that all of the teeth of the protruded arch or arches would require to be moved back fully the width of a bicuspid. While I will admit that it would be possible to move the buccal teeth of the upper jaw distally that distance, with a long-continued and heroic application of the occipital and intermaxillary forces for patients even as old as twelve or thirteen years, the same amount of movement would not be possible with the lowers because of the impossibility of applying the occipital force; and for full protrusions, of applying to the lower either the occipital or the intermaxillary forces. And in any event, with molars that had naturally erupted in that position—or, in other words, which had not drifted mesially because of the premature loss of deciduous teeth—such an extensive movement would in all probability produce a decided distal inclination of the crowns, with no perfect occlusion, thus robbing the operation of its principal if not only element of retention; while the tipped occlusal planes would constantly tend to force the teeth back to their former positions; and, further, permanence of retention would still not be assured without the ultimate extraction of the third molars. And so, after all, this prolonged and questionable operation to satisfy a sentiment resolves itself into the question whether it is better to extract a bicuspid on each side followed by ease of correction and assurance of retention, than subject the patient and operator to far greater difficulties, with questionable possibilities of retention and the final extraction of the third molar.

Narrow upper arches with high domes, protruded V-shaped labial curves, with the buccal cusps occluding in the sulci of the lowers instead of on the buccal aspect, and the upper buccal teeth not lingually inclined are not uncommon, and usually are caused by a lack of proper development of the maxillary bones due to early diseases in the maxillary and nasal sinuses, adenoid vegetations, degeneracy, etc. As Dr. Angle has pointed out, correction would be futile without a removal of the cause. There is another equally important requirement which pertains directly to retention, *i.e.* proper means should be adopted to produce a *bodily* lateral expansion.

If lateral inclination movement of the crowns alone is produced, as would prob-

ably occur from an expanding jack as it is ordinarily applied, the occlusal planes would be so abnormally tipped that perfect occlusion could not be possible, while the main object of the operation would be so uncompleted that permanence of retention would be doubtful.

I might also add to this theme the teachings of those eminent writers and authors of text-books, Drs. Farrar, Guilford, Bogue, Goddard, and others on this side and across the water, to further show that all men of large experience in orthodontia recognize and lay special stress upon the importance of the influences of inheritance and occlusion, in considering the permanent retention of regulated teeth.

Beyond this I shall not attempt an outline of the various causes which operate to destroy the retention of moved teeth, nor describe in detail the imperfections and inadequacies of retaining plates and fixtures that have been and are still being used. There are, however, certain underlying principles that should be borne in mind:

First: Teeth that are moved by orthopedic processes from one relative position to another are for a considerable time—often for years—subjected to the physical forces of surrounding tissues, which tend to move them back toward the irregular positions they formerly occupied.

Second: These forces continue to operate until the stretched and bent fibrous structures are brought to equilibrium in their changed positions by the physiological processes of Nature. To most successfully aid Nature in the upbuilding of sustaining elements and structures, the moved and loosened teeth should be held relatively still during the entire period that is required for their permanent retention.

Third: A somewhat proportionate relation will be found to exist between the character of the forces required for movement and the reactive forces opposed to retention. In other words, if the movement will have required considerable force, the retaining fixtures will need to be of proportionate strength and stability, unless the teeth are brought to positions of positive self-fixation by occlusion. Again, the reaction will always be along the lines in the opposite direction to that of the movements—either rotation, inclination, bodily, or a compound of these three elementary movements—consequently the fixture should be so constructed and applied to completely overcome these reactive tendencies.

Fourth: As a rule, teeth that have been moved slightly are far more difficult to retain than those of extensive movements, because—as in ethical relations—ties of attachment that are slightly strained are far more liable to regain their former relations than if completely broken up. Adult patients frequently apply for treatment with no more than slight malturned lateral incisors, under the impression that successful correction can be easily and inexpensively accomplished, but which more often than otherwise will demand a permanent fixture to retain them. In these cases the movement should be carried considerably beyond the required position in order to sever as much as possible the original attachments, and then allowed to slowly return to nearly the required position, when the retainer is attached.

Fifth: Teeth that have been moved slowly will not require the same strength of artificial retention nor the same length of time as those that are moved rapidly, because Nature has had time to partially

complete the upbuilding elements of retaining bone structure.

Sixth: While it is a fact that teeth regulated during youth are more easily retained than if regulated at maturity or later in life, no rule can be laid down as to the time retaining appliances should be worn proportionate to age, so varied are the conditions and influences that obtain with different patients. In nearly all cases where the teeth do not receive the positive self-retaining support of occlusion, I require that the fixture be worn at least two years. During this time it should be removed as often as there is any doubt of the slightest imperfection in its cement attachments to the teeth, etc.

PRINCIPLES AND TECHNICS OF RETAINING FIXTURES.

To render the most aid in the upbuilding of tissues for the permanent retention of regulated teeth, the retaining fixture should be one that so firmly grasps the teeth that the several opposing forces are not only completely held at bay, but relatively lateral movements occasioned by mastication, etc., are prevented.

Anything in the form of a retaining plate which requires frequent removals for cleansing is objectionable, and far inferior to a cement-attached appliance for holding the teeth firmly in the desired positions.

The fixture should be as perfectly fitted, finished, and cemented to the teeth as a bridge denture, and so constructed that the teeth and gums can be kept in a healthy condition, while it is worn with the same comfort and unconsciousness that a filling or artificial crown produces.

To fulfill these demands, its appearance in the mouth is of the utmost importance. Patients and relatives will submit to long, tedious, and painful operations, often with cumbersome and unsightly apparatus, stimulated by the hope of ultimate success, but when the teeth are finally brought to a satisfactory position they naturally object to the long and continuous use of any form of appliance objectionably conspicuous or annoying.

One of the greatest objections to an attached fixture is the danger from decaying detritus lodged in the pockets of imperfectly cemented bands and uncemented extensions. To avoid this the appliance should be carefully examined at least once a month, and removed upon the slightest indication of any imperfection in its cement fittings. The teeth should then be perfectly cleaned; the appliance cleansed, replated, and recemented. A retaining appliance that is properly constructed and attached may be worn without removal from six to twelve months, and occasionally longer.

Uncemented extensions, such as flattened wires soldered or attached to bands and lying upon adjoining teeth, are objectionable.

I prefer to make all bands and extensions that are exposed, of gold alloyed with platinum. For exposed bands I use B. and W. gold, sold by The S. S. White Dental Mfg. Co., which I am told is coin gold alloyed with platinum. The bands vary in thickness from Nos. 39 to 36. For intervening bands whose exposed surfaces are cut away and the balance of the band completely covered with gold in the process of construction, I use German silver No. 40.

It is eminently desirable to use bands as thin as strength will permit, in order to leave the smallest possible spaces at contact points while the appliance is in position and after its removal. Also to

trim or cut away all portions of the fronts of bands, for the sake of appearance, that are not absolutely required for retention.

For extensions, I use clasp metal D wire No. 19, and for lingual reinforcements, clasp metal plate No. 28.

To illustrate the principles I have outlined, we will first consider a simple irregularity. (See Fig. 1.)

Fig. 2 is the common retaining fixture, which consists of a bar passed through a rotating tube attachment, or soldered directly to the band. This fixture can be made less irritating to the lips and more inconspicuous and permanent by

FIG. 1.

FIG. 2.

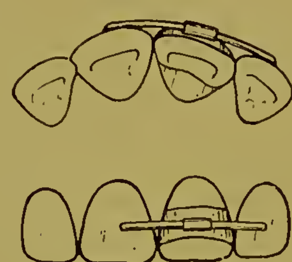


FIG. 3

bending a D clasp metal wire to conform to the labial surfaces, and soldering it to a perfectly fitted B. and W. gold band No. 38. The labial borders of the band are then trimmed nearly to the wire, and the whole perfectly finished and plated. (See Fig. 3.) The uncemented extensions which lie upon the adjoining teeth should be slightly convex on the under side and perfectly finished, and the patient required to frequently clean them with floss silk.

As uncemented extensions are at best often dangerous to the enamel upon which they rest, for young and somewhat careless patients I prefer the appliance shown in Fig. 4. The outer bands are gold No. 38, with joint on the lingual aspect, and the intervening band, German silver No. 40, with joint on the labial. I usually cut the outer or pier bands somewhat after the pattern that will be described for the canines, but of course according to the size of the teeth. (See Fig. 10.) The bands are carefully fitted and burnished to the inequalities of the lingual surfaces, and a partial impression is taken, using only sufficient plaster to submerge the bands. The bands are carefully removed from the teeth with the removing pliers, and accurately placed in their respective positions in the impression, and their inner surfaces luted with a thin solution of plumbago—*but not between the approximal surfaces*—to prevent the flow of solder. The plumbago may also be flowed over the plaster for the purpose of separating.

The impression is now filled with investing plaster, and the model, with the bands in place, is trimmed to a minimum size of stability for soldering. A small appliance of this character will usually require no lingual re-enforcement plate.

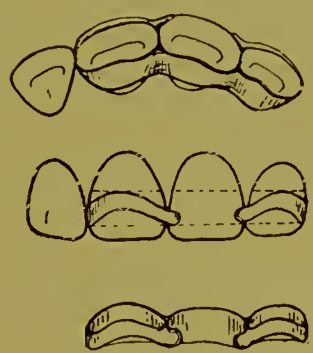
Commencing on the lingual side the solder, No. 20 gold, which unites the bands is caused to flow somewhat over the lingual surfaces to stiffen them. The model is then turned and small pieces of B. and W. gold are placed over the contact points and extended out upon the

German silver band to form a nucleus for the flow of solder to cover the final labial extensions.

In finishing, the lingual face of the intervening German silver band is cut away, leaving only the labial extensions. All thickened interproximal portions immediately rootwise from the contact points should be ultimately removed.

The important feature in this char-

Fig. 4.



acter of an appliance lies in the fact that every part in contact with enamel is perfectly fitted and securely cemented, thereby insuring stability of position and immunity from harm so long as the cement attachments remain perfect.

In Fig. 5 both laterals are malturned.

Fig. 5.

Fig. 6 shows an improvement over the bar attachment that is commonly recommended. In construction it is similar to Fig. 3.

Fig. 7 shows the appliance I would advise, which is constructed similar to Fig. 4. It will be found equally applicable where all of the incisors are malturned, but in alignment with canines that are properly posed.

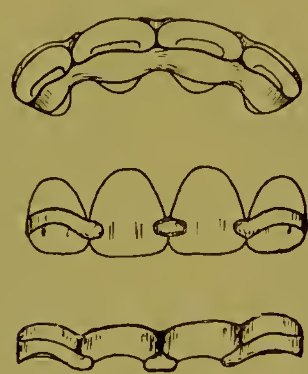
In a large proportion of irregularities all of the labial teeth are more or less

Fig. 6.

malposed or require to be moved to bring about a proper arch alignment and occlusal relation.

Fig. 8, which includes the canines, is very similar in construction to the appliance last described. This was first published in the *Ohio Dental Journal*, Janu-

Fig. 7.

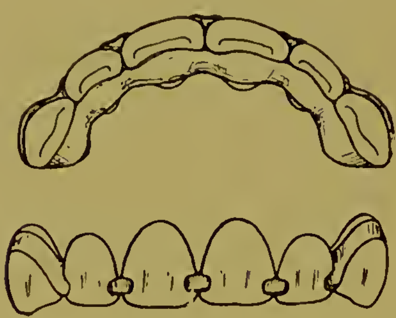


ary 1898, and represents the standard retaining appliance which I have successfully used in my practice for hundreds of cases for the last ten years.

I have found that by holding the labial teeth firmly in their relations to each other they rarely move in phalanx, even after the correction of quite decided protrusions or retrusions.

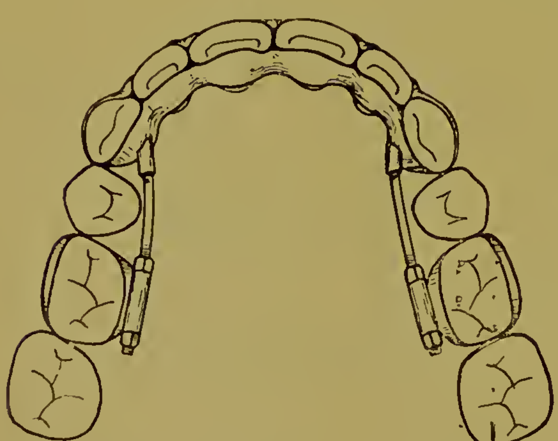
Again. after the correction of a narrow V-shaped arch by preventing the labial teeth from reacting, the bicuspids and even the molars rarely move though not otherwise sustained. In cases of de-

Fig. 8



cided protrusions and retrusions, however, and particularly when the incisors have been moved bodily in phalanx, provision is always made for lingual bars to the molars to overcome the tendency toward reaction. (See Fig. 9.) The figure

Fig. 9.



represents the retainer, which in my practice invariably follows the contouring apparatus where great rigidity of the bars is demanded to prevent the reaction of moved roots.

The bars are extra hard German silver wire No. 16, screwed into heavy internally threaded tubes, soldered to the labial surface of the appliance. To solder the bars directly would soften them, and possibly abort the object.

When the retainer follows the ordinary protrusions, where bicuspids have been extracted or otherwise, it is provided with short tube attachments soldered to the extreme linguo-distal borders, into which No. 19 bars may be hooked, if found needed, to extend to the molars, as shown.

Unless this labial retainer can be constructed with the same skill required for crown or bridge dentures it had better not be attempted, because it will fall short of its desired object, and may easily result in a thing which cannot even be placed on the teeth; or one which, if attached, will not hold the teeth firmly; or in itself force them to irregular positions.

Long experience in its use has taught me the importance of certain exact requirements in its construction which, if followed, will result in an appliance that will fulfill every demand and one, moreover, which the most fastidious patient will not object to wear the required time.

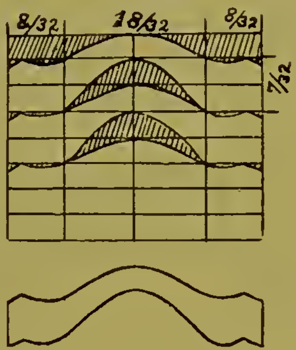
When the teeth are in correct positions. after extensive movements, no force should be exerted through the medium of the regulating apparatus for a week or two except that which may be accomplished with light silk ligatures to hold the teeth or slightly true them up.

As it is always desirable to place the retainer the same day that the apparatus is removed, an early appointment is made in order to have plenty of time; though in an expert handling of the work two and sometimes three of these appliances can be made and placed in one day. When a six-band appliance is first placed it is not cemented, but allowed to remain

about one week upon the teeth, that they may become adjusted to it and facilitate a quick placing, required by the setting cement.

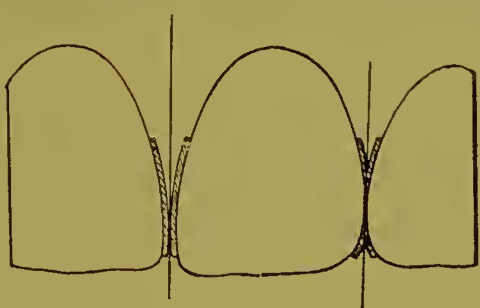
When the regulating apparatus is removed, the teeth are cleaned of cement, etc., and the retainer bands fitted, as described.

FIG. 10.



In order that the canine bands—which are the only ones when finished that encircle the teeth—shall be as inconspicuous as possible, they are cut from a pattern which provides for a wide lingual portion with joint, and a narrow labial portion, which conforms to the gingival

FIG. 11.



line. When properly soldered, fitted, and contoured, this pattern will be found to perfectly fit every canine.

A piece of No. 36 B. and W. gold, one and one-sixteenth of an inch wide, is annealed, and marked as shown by the straight lines in Fig. 10. A little practice will enable one with a delicate pair of curved manicure scissors to cut the pattern band shown in the lower part of the figure.

FIG. A.

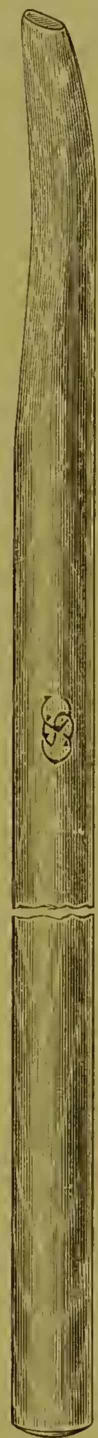
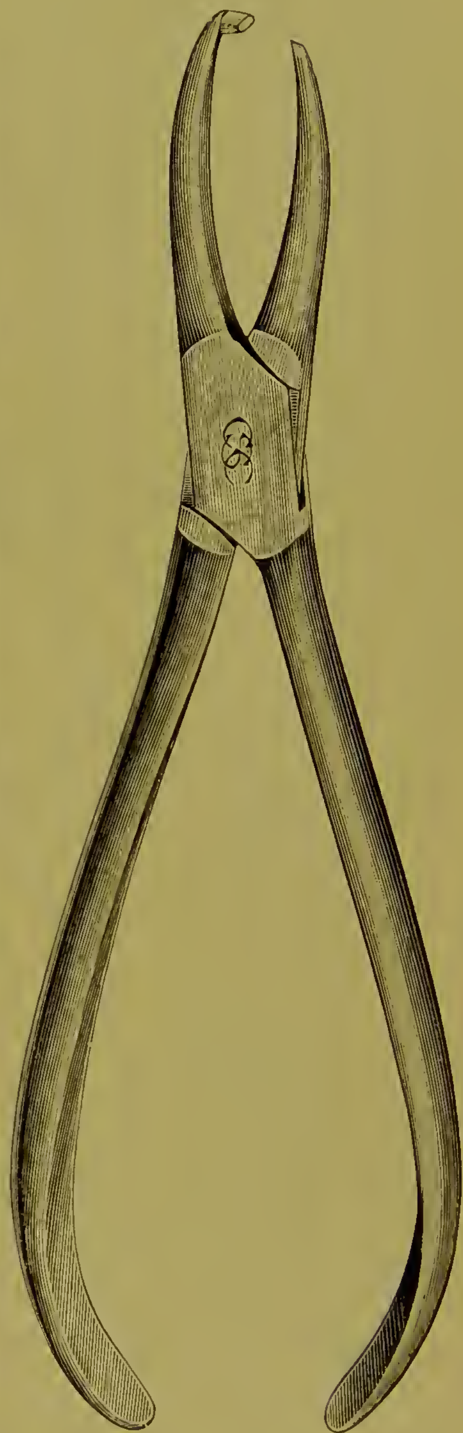


FIG. B.



The thickness of this band (.0045) with that of the adjoining one (.003) will produce about as much space between the canine and lateral as would be

caused by two layers of common writing paper; and this can be reduced at the contact point, if desired, with a paper disk, as shown in Fig. 11.

The incisor bands are No. 40 German silver, and sufficiently wide to reach the interproximal gingivæ. There is not much use in trying to fit a thin wide band that requires forcing on and off the teeth several times, without proper tools, *i.e.* a hardwood plugger with end large enough to cover a considerable portion of the edge of the band, and a pair of specially constructed band-removing pliers, the extreme end of one of its beaks being turned at right angles and shoed with copper, or some soft metal, to safely act as a fulcrum resting upon the incisal edges or occlusal surfaces. (See Figs. A and B.)

When the bands are placed, an impression is taken in investing plaster, and treated as described. (Fig. F.) In separating, the lingual portion of the impression is saved (see Fig. C), from which to obtain the die for swaging the lingual reinforcement piece of Nos. 30 or 28 clasp metal plate to stiffen the appliance. (See Figs. D and E.)

The general flare of the labial teeth often occasions considerable difficulty and pain in placing the appliance when finished. This has been one of the greatest drawbacks to its general adoption, though much has been due to the lack of perfect accuracy and care in its construction.

FIG. C.

FIG. D.

FIG. E.

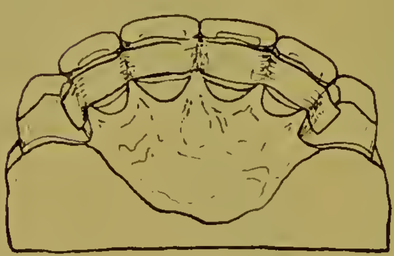


FIG. F.

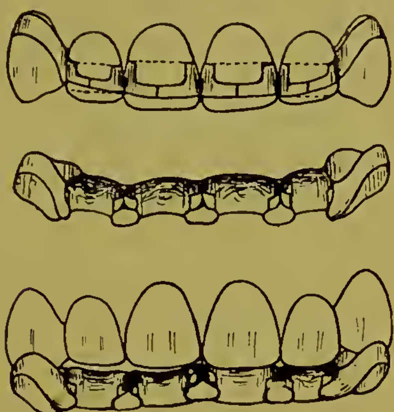
It will usually be impossible to place the appliance upon the teeth for the first time, if started with the canines. It should be started at the median space; then the laterals, and, finally, the canines. When it is forced to a starting position upon all of the teeth, it can then be easily malleted to place with the wood-plugger.

To facilitate starting the appliance at the median space, etc., in the preliminary fitting of the bands the interproximal portions of the incisor bands are left the full width to act as entering wedges in the first placing; the bands being other-

wise trimmed, as shown in the upper part of Fig. 12.

In fact it is often desirable to have the approximal entering extensions, for the *first* placing, much wider than those shown in Fig. 12. This may be accomplished by having alternate incisor bands wider. As will be explained, these are cut away in the *final* placing of the appliance.

Fig. 12.

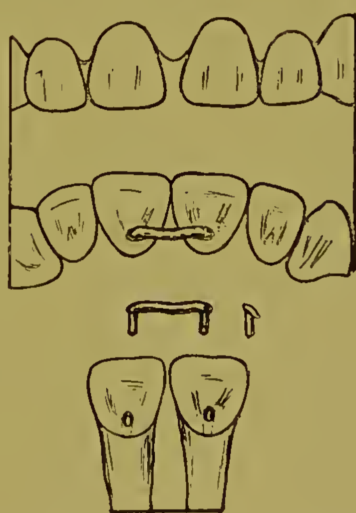


To prevent the solder from producing thickened portions in the interproximal spaces above the contact point and thus abort their object, the interproximate extensions are pressed closely together *before* filling the impression with the bands in place. (See Fig. F.) Another important move at this time is to burnish the gingivo-lingual edge of the band firmly against and slightly into the plaster impression, as it is liable to slightly contract in soldering, and thus strike the lingual edge before it should, in placing the appliance. After soldering, the approximal extensions are filed to a knife-blade edge.

The middle and lower sections of Fig. 12 show the appliance unfinished, with the approximal guide extensions ready for the first placing. In the final placing and cementing these are cut down and finished to the contact point extensions that are covered completely with gold, as shown in the lower drawing of Fig. 8.

After a six-band appliance of this character is finished, it will at times seem to be impossible to place over the flare of the labial teeth, whereas the same appliance might be readily placed by the hands of an expert. However, when it seems to be absolutely impossible to place the appliance, as sometimes occurs, there is no objection to sawing it in two, through the lingual section of one of the centrals, which will enable a temporary placing of the appliance for a few days, when an impression is taken, etc., as described, and the cut surfaces soldered. The teeth, in the meantime, will have become so adjusted, that a second temporary placing will be possible, preparatory to the final cementing.

Fig. 13.



It will be understood that this appliance is quite as applicable for the lower teeth.

When the upper or lower buccal teeth are moved distally, mesially or reciprocally with the intermaxillary elastics, or the labial teeth are extruded to correct open-

bite occlusions, provisions are made for a continuation of a moderate degree of this force; the details of which will hardly permit me to explain at this time.

The subject of retention would not be complete without mentioning a permanent retaining appliance that is especially adapted to follow the correction of that somewhat common irregularity that is characterized by abnormally wide interproximal spaces, usually between the central incisors and commonly caused by a close-bite incisal occlusion which is increased later in life by the wearing away of masticating surfaces. (See Fig. 13.)

This retainer with full description of its construction and application was presented at the Odontological Society of Chicago, April 1903, and published in the *Dental Review,* February 1904.

It essentially consists, when finished and in place, of a close-lying bar that extends from one linguo-gingival ridge to the other. The ends of the bar are turned at right angles to enter pits bored in the teeth, in which they are firmly cemented.

I regret that the length of my paper will not permit a fuller description of this valuable appliance and the technic of its construction. While I have at present used it only for the above-mentioned cases, I have no doubt of the practicability of this principle, with slight variations in its construction, for more extensive irregularities and also for the permanent retention of pyorrhea-loosened teeth.

Discussion.

Dr. Varney E. Barnes, Cleveland, O. It was expected that Dr. Guilford would open this discussion, and I hoped to hear his remarks first. However, as I have used the retention advocated, I feel it only just that my experience should be given.

In the first place, I wish to commend what Dr. Case has to say on the subject of inherited tendencies. Many of the writers of the last year or two have not agreed with him in this matter; but I must say that experience with cases treated has shown that cases with inherited tendencies are much harder to retain than other cases. As yet, I am not satisfied that extreme cases of class II, Angle classification, are going to be retained permanently. Some may, but others indicate that they will not. Time and scientific investigation alone will prove this.

The essayist said that occlusion of the anterior teeth is the most important. It is not so. It is only apparent at a superficial glance, and will not bear close investigation or the test of years. The patient and parents may be satisfied, but what about the whole occlusion? Retention of the anterior teeth does not by any means indicate that the posterior teeth are to remain retained and in correct position. We want good results all around the arch and the best results where they are to give the patient the most good. This is the most important; with it you are certain to have good appearance also.

He has also brought up the subject of extraction of the first or second molar in preference to the possible later extraction of the third molar. Look at the history of these same third molars and put its insignificant value alongside of the proved utility of the first and second molars. As for extracting immediately in protrusion cases, too much con-

demnation cannot be expressed, because you cannot tell beforehand that you are to have failure without extraction unless you try it. Try *without extraction* first; if you fail you still have the other method. This I believe is the only justifiable method. If you extract without trial you are guilty of malpractice.

I am not able to agree with the essayist that a removable retainer is not a good thing. In many cases it is good. It depends very much on what we know of our patient and the case whether we will use a fixed or removable retainer. Some will never wear this kind of appliance, while others will wear it and take care of it. On some patients you cannot get the retainer too strong or well attached. It is a matter of judgment, no fixed rule will hold.

Extremely rigid appliances are not, in my estimation, the best. The ideal appliance would seem to be one fixed at one end and flexibly attached at another, approximating nature's mobility of the teeth. Let us have rigidity in the direction of a return to the original position and a degree of flexibility in all other directions. When a rigid appliance is taken from teeth they are somewhat loose, but soon tighten. Would not a semi-flexible appliance reduce this looseness?

As to this retainer as shown on the screen, I may say that I have used it for over three years, finally giving it up because it was only good for well-shaped teeth in the anterior part of the arch. The more important teeth are not held by it. The spaces left between the teeth were too great. I found that the cement would wash out and would often not be noticed. The little lugs would break off, necessitating the removal of the entire appliance.

Dr. S. H. Guilford, Philadelphia, Pa. I have listened with pleasure, interest, and profit to the paper of Dr. Case. Dr. Case and I work along very similar lines, his views and mine corresponding very closely.

This matter of retention is one of the most important in the whole range of orthodontia. In the early days it was very much neglected and undervalued. I remember very distinctly how much I was criticised many years ago for undertaking to regulate teeth before all of the permanent ones had come into place. I was told that it was wrong and cruel, and that the effects would not last. It was not so, for the simple reason that at that time we were already in possession of a little device or method which had not been in use very long, namely, the cementing of a band to the natural tooth. To my mind it seemed to solve the whole problem of retention, or nearly so. Previous to that time those who regulated teeth brought them into correct position but they did not hold them there, or held them for too short a time. and the result was that the teeth went back to their old positions, resulting in failure. This was of such common occurrence that it came to be a common saying that "you can correct irregularities, but you cannot retain the results obtained." Magill's idea of simply cementing a band on the tooth was one of the greatest advances in orthodontia up to that time, and even now I do not see how we could accomplish satisfactory results without it.

There was one point that I wish Dr. Case had emphasized more fully. He alluded to it, and that is the question of retaining the teeth in the fixed or permanent position. Magill's plan enables us to form a variety of splints, attach them

to the teeth and hold them so firmly that they cannot possibly move while the new tissue is being formed around them. It is doing what the surgeon does when an arm or long bone has been broken. He places the parts in position and adjusts the splints so as to prevent the parts from moving while they are being united.

As to the appliances themselves, we must make them, of course, to suit the conditions which are present. I was very much surprised today in going through the adjoining room to notice a collection of models of corrected irregularities, on many of which the note was made "Retained in position six months," or "eight months," and so on. While the gentleman undoubtedly accomplished good results, I do not see how he will retain them in so short a time. The retaining must be continued for a sufficient length of time. As to how long it shall be, that is determined by the character of the irregularity which has been corrected, by the age of the patient, and a variety of other conditions. But we must hold them in their new positions sufficiently long, and before dismissing the patient and calling the case finished we must see that the teeth do not go back to any appreciable extent.

My plan is, after I have placed the retaining appliance, to see the case at frequent intervals until a sufficient length of time has gone by to warrant its removal, then I take it off and allow the patient to go for a few days or possibly a week, and then have him return. The retaining appliance is then placed loosely on the teeth, and if it goes into position without any special effort, I conclude that the teeth have not begun to move back. I may then let it go for two weeks, and the next time three weeks, and keep on in that way until I am satisfied that the results obtained are permanent.

Another point is that we cannot predict with any certainty whether the teeth are going to remain in as good position as they were when we finished the work. This is because with all our care the teeth are liable to move a little out of their former positions; you will notice that particularly in cases where the irregularity seems to be very slight. For instance, the torsion or turning of the upper lateral incisors where they are just a little out of place. Under those circumstances the essayist recommends that they be turned a little beyond their proper line. Certainly that is the correct plan. I mention this because moved teeth will often change their positions slightly, even after long retention, and we should provide for it in advance. Even then, however, we cannot always expect to retain quite as good results as we had at the time the operation was completed. I therefore feel that by the retention of the teeth by proper means and for a sufficient length of time, and by a careful examination after we have decided to remove the appliance, we can frequently get a result which under other circumstances we would not be able to obtain. This feature of regulating has not as yet been sufficiently emphasized and dwelt upon either in the text-books or in college teaching, because those who teach and those who write frequently take for granted that others know as much about it as they do. It is one of those things that needs to be emphasized, and I am glad that Dr. Case has dwelt upon it at such length.

Dr. R. Ottolengui, New York, N. Y. Shall we have a fixed retainer or a movable retainer? The question was dis-

missed almost in a line by the essayist, who says that there is rarely any use for a removable retainer. The fixed retainer serves a very useful, but very rare purpose; the removable retainer answers very nearly all cases. Dr. Case admitted after dismissing the removable fixture that the fixed retainer should be examined once a month. Now if that is admitted, that is almost enough to throw it out of practice. All patients cannot be seen once a month; many patients often come from a distance for this special work, and when they leave it should be possible for the operator to feel sure that he will never feel like returning a part of the fee should he receive a letter from a thousand miles away saying, "My teeth have returned to their original condition."

What has been advanced as the objection to the plate as a retaining fixture? That it is filthy; but it is not. That it will injure the teeth, but it will not—that is, if it is properly applied and properly made. On the contrary, I wish to state unhesitatingly, after fifteen years of continuous use of this apparatus, that the patients in whose mouths I have placed it, and patients who have continued in my care, have required less filling operations than any other patients who have come to me; and why? Because this removable fixture, as I make it, is of iridio-platinum—a plate with either gold or iridio-platinum attachments; and the little patient is instructed that it must be daily removed and boiled in soda, that it is to be removed before the meal is eaten, and the teeth are to be cleaned before it is returned; this rule, which is insisted upon, does much to create a prophylactic habit in the patient at an early age and so does more in an inferential or suggestive way to preserve the teeth than it could possibly do to injure them.

At first observation is made of the direction in which each tooth has been moved. A model on which the retaining fixture is to be made is carefully carved, by which I mean if we see a lateral incisor has been moved inwardly, the labial surface of the lateral incisor is slightly trimmed away, and so wherever a tooth has been moved or a part of the tooth has been moved a portion of the surface of that tooth is trimmed away, then after the plate has been fitted to the mouth a surrounding wire is made to absolutely touch the plaster model at every point. Thus when it is in the hands it may appear to be a simple wire encircling the teeth. It is more than that; it has an invisible stress within itself; there is a special bearing on every tooth which has been moved, a bearing in the direction in which the teeth were moved and a tendency to prevent them from moving back. That is my appliance. As I said, it is used for everything except extensive rotations that involve extensive softening of the socket. Such teeth should be held rigid long enough for bone to be deposited. Frequently such fixed retainers may be made and worn in conjunction with the removable appliance.

With the removable appliance we have the advantage that there is absolutely no limit to the time it may be worn, and you are not disturbed in your mind by the etiology or inherited tendencies of the case. "There is your retaining fixture, my little girl; you must wear it as long as your teeth have any tendency to return. If you wish to go to a ball, leave it at home, and don't carry that disfigurement with you to the ball. If you have company, remove it." But for

the first six or eight months you give your patient no such latitude. Later on the appliance is worn only at night.

But there is absolutely no limit to the time which the appliance must be worn. To show the usefulness of this I have recently had in my office a little patient (now twenty-two years of age) who has a fixture which was originally placed on her tooth when she was fourteen years of age. She has several times reported to me that after leaving it out three or four months she noticed a slight movement back to the original position. But after replacing the original retainer the tooth regains its correct position.

Dr. Case (closing the discussion). From experience in my own practice, patients who wear a fixed appliance that is immovable and perfectly attached to the teeth with considerable strength and stability and has a strong and long rigid bar on the tooth, apparently holding the teeth firmly in position, I find that even with this appliance cemented to the tooth I cannot in many of my cases hold the teeth; how, then, is it possible to hold a tooth with a plate that a little child can put in and out of the mouth at will—a plate which has no rigid grasp on the tooth—what could be said of such a plate as that? In these cases where the arches of the teeth have been moved considerably, with great tendency of the arch to return to the former position, and in fact with sufficient force to even bend unannealed wires of No. 16 gage (and I often get that condition) I have to remove the wires and place larger ones in to prevent that great force exerted by moved roots in their tendency to change position. Therefore I do not see how it is possible that a plate would suffice.

The session then adjourned until Wednesday at 2 P.M.

SECTION VI—Continued.

THIRD DAY—Wednesday, August 31st.

The session was called to order at 2.15 P.M. by the chairman, Dr. Angle.

The CHAIRMAN. The next paper to come before this section is one by Dr. R. OTTOLENGUI of New York city, entitled "Spreading the Maxillæ *vs.* Spreading the Arch."

The paper was then read, as follows:

Spreading the Maxillae vs. Spreading the Arch.

By R. OTTOLENGUI, M.D.S., New York, N. Y.

ONE of the most important movements in the regulation of malposed teeth is the so-called widening of the arch. Formerly in nearly all crowded dentures the requisite room for rearrangement seemed to indicate a lateral widening, usually in the bicuspid region, and this was the common course of procedure. Today much of the space demanded may often be obtained by the distal movement of molars, and even of molars and bicuspids, thus giving the desired opportunity for torsion and rearrangement of the anterior teeth.

In both procedures the same principle underlies, and I beg to call especial attention thereto. The additional space is obtained along an imaginary line which bisects the incisal edges and occlusal surfaces. In one instance this imaginary line is stretched laterally and in the other it is prolonged at each extremity. In both, the teeth are moved in their sockets. This entails two very objectionable features. The molars and bicuspids are loosened, and can never again afford the same stability as anchorage for final retention as where similar results are obtained without disturbance of their sockets. A greater difficulty obtains where the teeth are erect at the outset. The widening often results in a buccal slant which precludes the immediate possibility of perfect occlusion. In a great many reports of cases from practice, shown in the past, I have noted otherwise perfect results marred by the outward tipping of the first molar. After calling attention to this, those present will undoubtedly observe the same feature of many cases shown on the screen and in models at this meeting. It is

frequently an unavoidable result of using the first molars to carry anchor bands, where widening of the arch is coincident with the application of force in many places at once for the torsion and rearrangement of malposed teeth. It is noteworthy that this buccal tipping of the molar is most common in the upper jaw. The reason is that the two buccal roots offer more resistance to the force than does the single palatal root. Thus the buccal roots act as a fulcrum, while the conical shape and the slant of the palatal root allows that root to be withdrawn from its socket, so that the tooth tips buccally, and at the same time is slightly raised, thus opening the bite. It is this latter fact which makes final success possible by this method. Its advocates tell you, and they tell you truly, when comment is made, "The molar will return to its erect position, and the bite will close."

Theoretically, and often practically, this is true. But it can never be true if anything like a really rigid retainer is applied, for in that case the retainer must retain the molar fixedly in its malposition, except that it may be driven up into its socket. Many cases shown in the past have proved this, for I have noted in many photographs and models that the occlusion has been closed while the anchor molars remained tipped. Thus, where this occurs, the tipped molar cannot be utilized as an anchor for retention, and this, I think, is a great deprivation to the orthodontist who is anxious to see his results remain permanent.

This, in brief, is my argument against and my objection to any method of widening the arch by fixtures applied solely to the teeth, more especially where the rearrangement of other teeth is attempted coincidentally with the lateral movement of bicuspids and molars. This objection of course does not apply where but one or two instanding teeth are to be moved buccally. Neither does it apply so forcibly, if at all, to the lower jaw, where the position and shape of the molar roots afford an equalization of the resistance with consequent unlikelihood of tipping.

It is the present fashion or fad to deride the use of plates. There is much that might be said, and perhaps which should be said against the dogma which entirely discards the use of a roof plate; but at present I shall speak of the plate only as an instrument for attaining with certainty and dispatch a much desired result which, so far as I know, has been only occasionally obtained by other means.

In a discussion of this general subject before the Chicago Dental Society, February 1893, a report of which will be found in the *Dental Review* of March of the same year, Dr. Black is reported to have said that he often undertook to widen the arch by opening the suture, using a so-called Coffin plate, with a jack-screw, and he fully explains the advantages of this mode of procedure; but he adds: "I have done this in a number of instances with the happiest results. . . . . but you cannot do it in every case, and should not try it except with young patients."

I shall have the honor to present for your consideration a method by which the maxillæ may be spread by opening the suture in the majority of cases. While of course the disarticulation of bones is more readily accomplished in early youth, the force which is employed is so irresistible that the result may be consummated in practically all cases where

the services of the orthodontist would be demanded. Moreover, the method is certain, swift, and painless. No teeth are loosened, the two halves of the bone being moved bodily apart. It is the only method known to me which immediately stretches the imaginary line of the arch above mentioned at its center, thus supplying the added space for tooth movement just where it is most required. For example, suppose the common case where the two lateral incisors are malposed and imprisoned lingually. By spreading the maxillæ, the greatest widening is at the median line, and we have but to draw the two centrals together again, when at once we have the required room for moving the lateral incisors labially. The same is true in the so-called V-shaped arch, with protruding central incisors. Space is immediately obtained just where we need it for the torsion and reduction of the prominent teeth. In those cases where the narrowing of the upper arch imprisons the mandible in a distal pose, the correction of which demands what we call a jumping of the bite, a spreading of the maxillæ promptly releases the lower jaw and permits an immediate readjustment of the occlusion. While I have been using this method some ten or fifteen years (or perhaps longer), unfortunately, for reasons which need not be here given, my collection of models is less than two years old. I have chosen, therefore, a single case, upon which I was engaged when promise of this paper was made to the chairman of the section, and with this one record I will endeavor to indicate the advantages of the procedure, and then describe the technique.

FIG. 1.

FIG. 2.

Fig. 1 shows occluded models of the case as presented. I have chosen this side for illustration because it is the more interesting. A casual glance would indicate that the molars are in true occlusion and that the prognathism is very great. Closer scrutiny shows that the deciduous molar evidently was lost prematurely, and thus the second bicuspid is imprisoned through the forward tipping of the molar and the backward movement of the bicuspid. A study of the profile shows that the protrusion of the upper incisor region is not great, while the retrusion of the chin is quite marked. Diagnosis there indicates a spreading of the maxillæ to widen the

arch and release the lower jaw, and a distal movement of the lower molar, with mesial movement of the first bicuspid to release the second bicuspid which a radiograph showed to be buried deep in the jaw, scarcely more than the tips of the cusps appearing on the skiagraph.

The apparatus for spreading the maxillæ was applied and two weeks later this part of the work was completed. Fig. 2 shows the occlusion after the spreading, though the models would show to better advantage. A close scrutiny of the picture will show shadows under the upper cuspid and bicuspid, indicating that they now extend buccally beyond normal occlusion.

Fig. 3 shows the occlusion when the jaw is moved forward, as in jumping the bite. The afore-mentioned shadows disappear, showing that the upper jaw is now wide enough to receive the lower in its forward pose. The malposition of the lower bicuspid and molar prevents proper occlusion, and now we see most distinctly that the molar must be moved distally, the bicuspid mesially, and that with the lower jaw brought forward the upper protrusion is not great, verifying our diagnosis. I would also call attention to the fact that at this period there was no buccal tipping of the upper molar.

Fig. 3.

In Fig. 4, we see the upper protrusion corrected, occlusion perfected, and space gained for the lower second bicuspid. A day before I left New York, two weeks after these models were made, the lad reported to me, and I had the satisfaction of seeing the tips of the erupting bicuspid. In this figure I call attention to the fact that the molar is now slightly tipped bucally. This is due to the fact that Angle bands and intermaxillary force were used for reducing the upper prominence, and in spite of the fact

that no further widening of the arch was required, still the spring of the arch band was sufficient to cause this slight tipping. Consequently I have banded the bicuspids as supports for a retainer which is to be worn during the summer, thus leaving the molars free to return to proper occlusion, which I have no doubt will be as good when I see the case again as it was at the outset. (See Fig. 1.)

That you may more thoroughly comprehend the alteration of the shape of

FIG. 4.

the upper arch, I must show you the palatal aspect of the upper jaw. Fig. 5 shows the condition at the outset, and Fig. 6 the present condition. The deciduous cuspid in the interim has been shed. Fig. 7 shows the jaws spread, two weeks after starting the work, the opening of the suture being indicated by the space between the central incisors. Usually, the application of the instrument is such that the suture is opened, as we open a pair of scissors, the greatest widening being at the median line between the incisors, which is exactly the reverse of the action or tendency of the arch band. The latter exerts its greatest force across the molar region, where it is usually least needed, and the widening of the bicuspid and other regions depends upon additional traction applied to individual teeth. By

FIG. 5.

the method here presented, as I have said, the suture usually opens widest anteriorly, but in the case shown measurement of the models prove that

FIG. 6.

the suture was widened almost equally throughout, probably due to the youth of the patient and the loose character of the articulation of the bones.

The use of the Coffin plate with spring attachment is familiar to you all. Another form of split plate exerts force through the medium of a jackscrew. I

believe that jackscrews of today are better in shape and smaller in size than those of twenty years ago, but as it is nearly that long since I have had recourse to one for widening an arch I cannot say what may or may not be accomplished with the newer forms. When I first undertook orthodontia I found the Coffin plate and spring most unsatisfactory in my hands. I made frequent use of the split rubber plate with the jackscrew, and in one case having fortuitously opened the suture I quickly

Fig. 7.

noted the tremendous advantage gained and set about discovering a means of doing so at will. My experience with jacks was similar to that quoted from Dr. Black. Success attended occasionally only. Theoretically the split plate presses against the sides of the arch. Practically this is not true except as noted by Dr. Case (*Dental Review*, March 1893) where the arch is narrow and the vault high. The plate is called a split plate, but really it is only split part way, the slight connection serving both to keep the plate in position and as a hinge. An analysis of the action of this plate with screw pressure will prove that as soon as force is exerted the rigid character of the hinge causes the plate to leave the actual surface at the summit of the dome, while the slanting sides of the process transmit the stress to the teeth. Thus, primarily it is the teeth that move. Dr. Case has ingeniously argued that this force against the teeth is transmitted to the buccal plates, carrying them outwardly, and that these drag the bone in the interproximal spaces with them, and these in turn drag the palatal process. I have no contention to make against this, for even though by this means the vault is widened, the widening is solely in the process, and it is the teeth which have been primarily moved. Moreover the teeth move a greater distance at their occlusal ends than at their apices, and this accounts for the buccal tipping. It is only by opening the suture and spreading the maxillæ that buccal teeth may be moved without tipping. At least I have not yet heard of any other means of accomplishing this with certainty and without loosening the teeth in their sockets and thus rendering them the less useful as anchorage for retention.

The displacement of the split plate and its withdrawal from contact with the dome is further dependent upon another principle common to all applications of force in orthodontia; with a single exception. I merely state it here, and shall make further comment later. The jackscrew exerts its greatest tension against the greatest resistance. This is the theorem. Analyze and you will better comprehend my meaning. The instrument is placed in the mouth and screwed up as far as possible. This is its greatest tension. The teeth at the same moment are offering their greatest resistance. The degree of stress permissi-

ble therefore is limited by the means of securing the plate in place, and this is very slight owing to the slant of the palatal surfaces of the teeth. As the teeth begin to yield we have a lessening of the resistance, also lessening of the stress and a consequent decrease in the stability, with probably loosening and even displacement of the plate. The last half of the theorem, then, is that with the split plate and jackscrew we have a decreasing stress exerted against a decreasing resistance.

FIG. 8

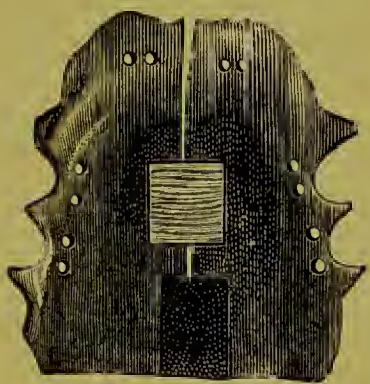


FIG. 9.

FIG. 10

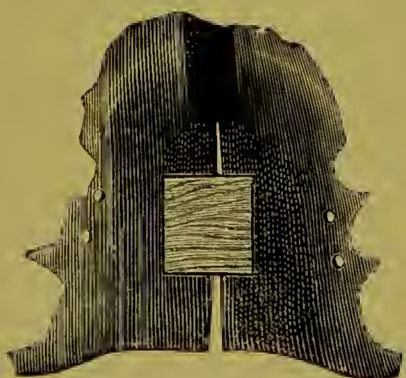


FIG. 11.

The plate which I use overcomes all of the objections mentioned, operates in a totally different manner, is universally applicable and almost unlimited in the scope of its usefulness.

It is made of vulcanite rubber, and is made as thick as the height of the vault will permit. At the center of the posterior margin before vulcanizing a piece of the rubber is cut away and replaced with velum or soft rubber. Thus, after vulcanization the plate is of hard rubber throughout, except at the back edge, where we have a small square of soft rubber. A square aperture is cut through the center of the plate into which is fitted accurately a plug of the softest pine. This aperture is slightly beveled so that the wedge of pine wood will be somewhat wider at the palatal than at the lingual aspect. Before placing the plug securely, as will be described, the plate is split through the hard center down to the soft rubber. Such a plate with pine wedge in place is seen in Fig. 8. Experience taught that this plate would be more serviceable if it could be made more rigid and if the pine wedge could be prevented from possible movement, thus precluding the chance of rising out of its bed and bruising the soft tissues. This is accomplished by drilling a hole through the

plate into the wedge, at each side, and pinning the same with orange wood. In Fig. 9 the orange-wood pin is seen cut off in one place and still protruding at the other. The plate is now ready for the mouth. Holes are drilled opposite the central incisors and bicuspids. In younger patients the holes would be opposite the deciduous molars, for it is one of the prime advantages of this plate that it can be operated in connection with deciduous teeth without the least danger of loosening them.

The plate is placed in the mouth and held in position by ligatures. I use linen thread, the contraction of which when wet renders the plate the more stationary. I tie to the central incisors, provided I wish to open the suture. This controls that result. Where widening across the bicuspid region only is desired the plate should extend no farther forward than the cuspids, in which case no stress will be exerted against the suture, or at least none great enough to open the suture. But if we tie to the centrals the maxillæ will spread apart. Usually we obtain all the widening desired in this manner, but occasionally we may require additional width in the molar region. This may be accomplished by placing the soft rubber hinge at the front and splitting the plate from the back end, as is shown in Fig. 10. In still other conditions, we may desire to move only the teeth of one side, in which case the split is made at that aspect as in Fig. 11. There are many other variations, but it is needless to record them; here I desire to set down only the principle. In practice I usually arrange to place the first plate in the mouth on Saturday. The patient returns on Monday and the plate is removed, cleansed, and the mouth thoroughly sprayed. A new and larger wedge is inserted and the patient dismissed till Wednesday. A new wedge is inserted and the patient returns on Friday. The plate is removed, cleansed, and an impression is taken, the plate being returned without changing the wedge. The patient returns on Saturday and an entirely new plate is introduced. The same series of visits in the second week brings the patient to us on the following Friday, with the maxillæ spread sufficiently for jumping the bite or other regulation. On Saturday a simple roof-plate retainer is put in place. This is worn for two or three weeks without being tied, and the maxillæ are kept permanently apart by the deposition of bone along the suture.

In the same number of the *Dental Review* from which I have already quoted, Dr. Case describes his use of the split plate with jackscrew force and he says: "The arch will be sufficiently expanded in from one to two months." Others have reported the same time as requisite, and such has been my own experience except where I used very short jacks, placed high in the vault, acting against plates made of iridio-platinum, entirely cut apart and held in place by bands soldered to them and cemented to molars and bicuspids. This was my first solution of splitting the suture, and even then I required from three to five weeks, seeing the patients twice a day for tightening the jacks. Now I accomplish the result in two weeks, seeing the patient three or four times a week. The screw pressure was painful, the wedge plate is painless. The screw-pressure plates even when cemented on often tore loose and were brought back in the patients' pockets. The wedge plates, properly tied, neither come out nor loosen in the slightest degree. I should mention

here that in order to lessen the chance of irritation from the ligatures the plate is tied first to the first bicuspids; at the next sitting to the second bicuspids; at the third to the first, etc., alternating so that each pair of teeth has a period of rest.

We come now to the underlying principle of the plate. The theorem for the jackscrew plate was, "The greatest stress against the greatest resistance; and in action a lessening stress against a lessening resistance, with consequent loosening."

The theorem for the wedge plate is, "The least, or no stress against the greatest resistance; and in action an increasing stress against a decreasing resistance, with a consequent tightening of the plate."

The wedge is the only force which is at its lowest stress when first inserted. In all other forms of force, the screw, the spring, the rubber, wire, or linen ligature, we have the greatest force exerted at once, and this force decreases as the tooth yields under stress; and it is this one fact, the application of the greatest stress against the greatest resistance, which accounts for ninety per cent. of all pain in orthodontia.

I pointed out how and why the split plate operated with a jackscrew exerts force against the teeth and widens the arch by moving the teeth in their sockets.

It is true that the same can be done with the wedge plate, provided the plate be not tied forward of the canine region. But if the plate be tied to the centrals, the immobility of the fixture, the resistance of the teeth of both halves of the jaw in phalanx, and the fact that the force is applied high up and directly next to the suture; all this coupled with the very important fact that the soft rubber hinge permits opening of the plate without dragging it down from contact with the dome, results in a spreading of the maxillæ by opening the suture, the resistance along this line being less than in the combined tooth sockets.

We have all in the past spoken quite freely of opening this suture, but I have nowhere seen any consideration of just what may occur when this is attempted. I have tried to obtain a young cadaver and apply this plate, so that I might study the anatomical results, but such subjects are rarely obtainable and usually in demand by specialists in close touch with the dissecting rooms. We may therefore only theorize, and I do so to open the way to further discussion.

The palatal suture being in the nature of the teeth of two cogwheels it would be easy enough to understand their disarticulation provided no other bone were involved. But just above this suture the vomer is inserted. What is the nature of this articulation? Does the vomer have a spreading base, and does its articulation straddle the palatal suture and thus have relation with both maxillæ? I think this is the normal condition, but I also believe that quite frequently it will be found that the vomer is deflected to one side and is articulate with but one of the maxillæ. In such cases the opening of the suture will be easier than where the vomer articulates with both, but even then the maxillæ may be spread, the result presumably being a sliding motion, the articulation opening throughout; that is to say, all three bones separating, or rather both maxillæ being drawn away from the insertion of the vomer.

Much has been said of the relation of the orthodontist and the rhinologist, and

yet it is hard to comprehend how the usual methods of widening the arch can materially affect the nasal cavity. By spreading the maxillæ apart, however, we do really add to the width of the nasal cavity and this gives added breathing room. This would be especially beneficial where the vomer is bent, thus partly or wholly occluding the nares on one side.

While reading the paper the doctor stated, interrupting himself, that he uses metal altogether in making his plates, and not rubber, with the exception of those described in the paper and illustrated by him.

At the close of the paper he showed a slide on the screen, one that had been loaned to him by Dr. Cryer, illustrating the opening of the suture in such manner that better breathing facilities were afforded. The essayist also spoke of the benefits to be derived from breathing pure air, and referred to a case where he had been prescribed for by a physician, but the latter upon learning that the essayist intended going to the Maine woods withdrew his prescription, saying that it would not be needed in that event.

The discussion of Dr. Ottolengui's paper was opened by Dr. W. J. Brady, Iowa City, Iowa. In the absence of Dr. Brady, Dr. M. T. Watson, Detroit, Mich., read Dr. Brady's discussion, as follows:

Discussion.

Dr. W. J. Brady, Iowa City, Ia. At first thought it appears somewhat startling to entertain the radical measure of spreading the maxillæ to the extent of opening the suture, as proposed in the past by various parties and now recalled by Dr. Ottolengui, yet on study of the subject it seems worthy of greater attention than has been given it. Dr. Ottolengui has presented the matter clearly, and has stated some truths concerning the ordinary method of spreading the arch that everyone of even limited experience in orthodontia must recognize as unwelcome phenomena accompanying most cases of this kind. The tipping of the upper molars and bicuspids as their crowns are moved buccally is a matter of concern to even the experienced orthodontist, and to many less skilled operators it has become a source of final failure on account of either the inability or the lack of foresight to keep this tipping within bounds where the final occlusion would allow the teeth in question to gradually work into a correct and stable occlusion to the full depth of the cusps. Even in favorable cases it takes some time for this to occur, and it must be admitted that the teeth are more or less unstable during this time and a source of apprehension lest something unforeseen may prevent the final good result.

The essayist, however, has neglected to mention the accelerated growth and development that follows a case of ordinary spreading the arch if done before the period of development is past. This after-development is not confined to the alveolar process but extends to all associated parts, including enlargement of the entire maxilla with its contained sinuses, and the undoubted enlargement of the nasal opening. The entire bony structure of the face seems to receive a stimulus from the artificial spreading of the dental arch, and accelerated growth and development persist for several years in most cases, bringing about a consider-

able outward movement of the apices of the roots of the teeth and correcting the initial tipping to a marked degree. There are too many authentic cases of the betterment of things from this after-development to doubt its existence or effects, and its correcting influence must minimize some of the conditions noted by the essayist as grounds for more radical procedure.

It might also be said in passing that this after-development is responsible for much of the improvement credited by some writers to wonderfully constructed apparatus for moving the roots of teeth outward. I have repeatedly gained the result of outward movement of the apices of the roots—especially of the anterior teeth—by no other means than by letting them alone after the crowns had been originally moved to place by the simple expansion arch. Nature is often robbed of her just dues by ambitious man.

The behavior of the alveolar process under pressure, as in regulating, needs much more elucidation, and on account of some of the known deficiencies of this structure I am led to believe that bodily spreading the maxillæ may be of value in orthodontia. The alveolar process has none of the ordinary provisions for the repair of bone. Nature provides but one method of change on this structure, that of absorption or new deposition. It is never repaired as other bone is by the throwing out of an exudate and provisional callus, with a new growth of bone in a few weeks. There is no repair by sub-periosteal renewal. If, as in some cases of necrosis, the periosteum be dissected away and the dead bone beneath be removed, there may be a shell of bone formed by sub-periosteal renewal, but such renewal is confined to the maxillary bone proper and no part of the alveolar process is thus formed. While it may be absorbed at almost any age, its deposit is another matter, and seems to occur only through the agency of the osteoblasts under conditions somewhat similar to its deposition in the first place around erupting teeth.

During the early years of life, the process is torn down and built up some three or four times, and during this period the teeth may be moved a great amount and the process will follow them and in the end be as solid and firm as can be wished. The heyday of this activity is from the eighth to the thirteenth year, but after that age it begins to wane actively till at from sixteen to eighteen there is but little active deposit of this bone. Some slight and very slow deposit may be secured even up to twenty-two or twenty-five, but it is poor in quality and decidedly unreliable for the serious business of retaining teeth in place. If the orthodontist fortunately secures his cases early the slight loosening of teeth that occurs in movement is of little moment; but if the patient is older than thirteen or fourteen it is a more serious matter, and it is in these cases that I believe opening the suture might be valuable. If the suture is held rigidly open there should be a new deposit of bone in the space the same as in any other fracture, and a few weeks should be enough to secure permanent widening of the bones. It should be said, however, that this is not an operation for a careless man, for it is easy to see how much harm might follow careless or slipshod methods, and there must be a certain element of danger in it at the best.

I have had some slight experience with cases of this kind, and must say that the suture is not difficult to open and is

practically painless. In two cases I tried to expand the arch by the old method of a jackscrew across the roof of the mouth and distributing the force by means of a bar on the lingual side of the bicuspids and molars, and in both these cases the pressure was applied with much vigor. Almost before I knew it—in about ten days as I remember it—the suture was opened, much to my discomfiture. I did not follow up the advantage gained as I might have done, but very hastily withdrew the appliance, and gained only the knowledge that the maxillæ could be separated both easily and without pain. No bad effects followed in either case. In another case, undertaken in assistance of Dr. Geo. V. I. Brown, it was desirable to open the suture and separate the maxillæ as much as possible to aid in opening the nasal opening closed by accident in early years. A very similar appliance as before described was used and the maxillæ separated a considerable amount in about two weeks, all without any pain to speak of. Unfortunately the patient passed out of reach in a short time, and I have no means of knowing how it is now. But the opening of the nasal tract was unquestionable, and the occlusion of the teeth much improved. All this is confirmatory of the essayist's findings.

But on the question of appliances for performing this work I must protest against the old rubber plate being dug up and exploited as a desirable appliance in this age of the world. If there is any one thing that is settled in all orthodontia it is the fact that the day of the rubber plate as a regulating appliance is past and gone, and let us hope for good. It is uncomfortable, unclean, and unreliable in every way for exerting mechanical force upon the teeth. There is nothing that can be done with it but what can be done with more comfort and less trouble in every way with something else, and the chances of failure lessened by a great percentage. The essayist's contention that the plate bears against the soft tissue and accomplishes the separation of the maxillæ thereby is without foundation. The pressure in such a case would be sufficient to cut off nutrition from the soft tissues if directed solely against them. The fact remains that the separation was accomplished by means of pressure against the teeth. If not, why the need of tying the plate to the teeth? The answer must be that without tying the plate would loosen and destroy the pressure which in the end was exerted most largely through the teeth. However, the question of doing is more important than the question of doing with, and if the desired end is secured by any reasonable means it should not be condemned just because somebody thinks it might have been done easier with other tools. Let us thank Dr. Ottolengui for bringing this matter to our attention, and each resolve to add something to the stock of knowledge concerning it in the future, and perhaps some of our present troubles may be lessened as well as human welfare promoted.

Dr. T. R. Griffis, Carson, Ia. I would like to ask the essayist how it is easily told when the suture is spread, or is open, without employing the X ray?

Dr. E. S. Talbot, Chicago, Ill. I would like to ask the essayist if he finds any difficulty in removing the peg that holds the block of wood and wedge in place when he comes to remove it?

The Chairman. I do not believe in a talking president or in the president doing much talking. I have tried to act

accordingly during this meeting, but I would like to say a few words in the discussion of this paper.

I am not going to try to settle the point as to whether it is advisable to widen the maxillæ by separating them at the suture or not. Notwithstanding the fact that I have widened a great many arches I have never seen a case where that had taken place. However, it seems to be of frequent occurrence in other men's practices, if we judge from their writings.

The point I wish to make is, I see no peculiar, mysterious virtue from the force derived from those very bulky and very unsanitary plates that Dr. Ottolengui has exhibited, over the force derived from a far cleaner, far more certain, and far more mechanical method, namely, by means of the expansion arch.

The doctor tells us that it seems to be a fad to run down plates. I answer, yes, and for the best of reasons. It shows progress. In the evolution of the science of orthodontia we have passed beyond the need of such a very crude way of applying force in tooth-movement. Plates are in disrepute because they are very filthy, very bulky, and very uncertain as to remaining in position, and it is never possible to have that control over tooth-movement with them that we have with more modern devices. I fully agree with Dr. Brady, that whatever can be done with a plate can be done quite as well with a skeleton form of device, and in less time and with far less inconvenience to the patient. I believe that plates as regulating appliances are forever out of date and have been for some time.

The only case the doctor has shown us to prove his point is a very simple case indeed—a case in which I or any one of my students could have expanded as much in one week as is here shown to have been done, and we would have used a very simple and well-known device—the expansion arch.

The doctor states that as the plate which he uses is split anteriorly, with it the dental arch can be widened in the region of the incisors, while this would be impossible with the expansion arch. Now this is news indeed and certainly shows the doctor's unfamiliarity with the expansion arch and its possibilities. The fact is, we can widen the dental arch in the region of the incisors just as easily as in any other, and we also have absolute control of the movement, singly or collectively, of the teeth in the arch, which we certainly do not have and cannot have with plates.

Now, as to widening the arch by its separation at the suture, it may be good practice—others must decide this point; but the doctor loses sight of the fact that there is another means of widening the vault of the arch and the maxillæ—a very simple means and yet a very important one. It is nature's force as manifested in the subsequent development of the jaws after the arch has been widened and the teeth placed in normal occlusion. If we will do this with patients of the age of the doctor's patients nature will be stimulated to go on and develop the jaws according to the original plan. I made this discovery a few years ago, and those of you who have read my book will recall several casts illustrating this point and the great changes that took place in the vault of the arch as a result of the teeth being placed in normal occlusion and enabled to perform their functions normally. Dr. Lourie made careful measurements and we were surprised to find that in two

years' time the apices of the roots of these teeth had been moved outward into normal, upright positions, so that if the molars do lean outward at an improper angle as the result of movement, I know that in due time the apices of their roots will follow the crowns. This seems to me to be a better and safer way. Yet if anyone can succeed better by other methods we should be broad enough not to want to change them.

Dr. M. T. Watson, Detroit, Mich. I wish neither to approve nor condemn this paper, but to merely state a few facts from my own personal experience. Dr. Ottolengui mentioned especially two points in this procedure. One that by widening the arch in the way he describes the molars are left in a stable and upright position to use as anchors for retention; and another that the enlargement of the nasal space is probably greater than where the arch is widened by the use of the expansion arch.

In regard to the first, take for instance a case in class II, 1st division—protruding upper teeth and narrow arch—and suppose we widen the arch with the appliance shown, it is then necessary to use the so-called Baker anchorage to change the mesio-distal relation. When we do that, according to Dr. Ottolengui we have rendered the molars unsuitable for anchorage, and therefore one of the chief objects in doing it according to his method is after all overthrown, as I see it. If I am wrong I will be glad to be corrected.

Now if there is any one subject in all orthodontia that I am vitally interested in, it is the relation of our work to rhinology, and I have studied it perhaps more than any other one feature of the work, and some curious facts have developed.

I will mention a typical case where the nasal passages were occluded by hypertrophy of the turbinates and also of the mucous membrane covering the septum. These tissues were hypertrophied to a remarkable degree, so that a famous rhinologist was utterly unable after some three or four years of treatment to restore the breathing to anything like normal. The child was still obliged to breathe through the mouth almost entirely. The dental arches in this case were very narrow, and during treatment were widened in a comparatively short time with the expansion arch. The upper teeth were not in protrusion, so that it was possible for the patient to get his lips together with no special effort; they naturally came together when the jaws were closed, but were held apart solely for the purpose of getting air. After the arch was widened by the use of the expansion arch a most wonderful nasal development took place within a few months. The patient was one who lived at a great distance and could not be under constant observation, but the letters from the mother were of such a nature that there could be no doubt about the improvement. She mentioned specifically that the boy slept with his mouth closed—that snoring had disappeared and that he breathed easily; she mentioned the improvement in his general health which you would naturally expect to take place when the child was restored to a normal state of breathing after he had been for years a mouth-breather.

I mention this simply to bring out the one fact that we have unquestionable increase of nasal breathing space in these cases. Just how they increase I think no living man can positively say. However, there are several things entering

into it of which we can be reasonably sure. The slightly increased nasal space allows the child to breathe better—that is, allows normal function to be partially restored—thus bringing about a development that would not otherwise take place; for any organ in which normal functions are being exercised develops better than where they are interfered with. I believe that spreading the arch must be the initial step, but I do not believe it is that alone which increases the nasal space to such a marked degree. I have in mind another case where the nasal soft tissues were hypertrophied to a marked degree and local treatment was of little or no value from a rhinologist's standpoint. This case was restored to a nearly normal arch, the lips came into natural apposition, and in eight months' time, without any local treatment, the child still living amid the same surroundings that she had for several years, the normal breathing capacity was increased to a very pronounced degree. Now, a strange feature of this case, in my judgment, is that the nasal spaces had been remarkably increased with only a very slight widening of the dental arch; and yet we see a most happy result so far as normal breathing is concerned. The restoration of normal breathing as a result of the ordinary orthodontic operation has led me oftentimes to wonder whether it is advisable to attempt to open the suture, or whether ordinary means are sufficient in young patients to stimulate nature to do her duty in restoring normal functions.

I mention these things that you may think of them and not that I wish to draw any definite conclusions.

The CHAIRMAN. If there is no further discussion I will ask Dr. Ottolengui to close.

Dr. OTTOLENGUI (closing the discussion). I am getting off very lightly, I think. Although Dr. Brady had a copy of my paper to read, he misapprehends me in one point. I did not mean to say that the jaw separates because the pressure was on the soft tissue, or that the resistance was on the soft tissue, and I distinctly said the reason the suture opens is because the plate is fixedly and permanently attached to the teeth on each side. The resistance of the teeth, of all the teeth in their sockets on each side, is greater than the resistance at the suture. Of course the force is against the teeth. What I did say about the soft tissue was that the Coffin plate which has been used and spoken of has usually a hinge at the back which is rigid, and when force was applied it came down from the roof of the mouth, whereas this plate having a soft rubber hinge remains firmly against the mouth; and that whereas the force of the screw is on a plane with the necks of the teeth, the force in this plate is immediately next to the suture.

I am told that the rubber plate is unreliable and uncleanly; that it is unnecessary. It is neither unreliable nor unclean, and it is absolutely necessary until someone shows us another instrument to do the same thing with more exactness.

A great many cases of opening of the suture have been reported, but they have all been sporadic incidents in other men's practice. I have been opening sutures intentionally and successfully for fifteen years. I can show you a drawer full of these instruments, and I have not kept more than half of them. There has been no pain, no inflammation, soreness, or after-evil of any kind in the use of these fixtures, except perhaps a little

redness which rapidly disappeared. I am willing to admit that a child could not sing very well with one of these fixtures in its mouth, but possibly two weeks' absence from a singing school is not a very great deprivation.

I suppose I may be pardoned if I say that I beg to be dissociated in your minds from the users of ordinary plates. I said, during the reading of the paper, that where I have used plates they are of iridio-platinum, which is much cleaner than German silver. There is no oxid, and you do not need to take so much care of it as of German silver. German silver is a great deal more unclean than a rubber plate in my hands.

Dr. ANGLE. It is the *form* of the appliance to which objection is made.

Dr. OTTOLENGUI. The rubber plate, as I use it, is clean; it does no harm. If there is any uncleanliness it is between the soft tissues and the roof of the mouth, and that does not produce injury to the teeth. I can show you patients who have had their teeth regulated and have had less decay than those who have not had them regulated.

Someone asked me how I can know the suture is open. I do not always investigate, to be sure. If I get the space wanted I am satisfied. But that it is opened I am sure in many instances, for I have felt the edges of both bones with my finger, and that is convincing. I have also probed with needles.

Someone asked whether there is difficulty in removing the pegs. It would be quite difficult to remove them were it not for the fact that you can split the plate apart and pull the little pegs out of the wood, and then it is easy to push them out of the plate.

A gentleman asked why a low force against a high resistance is an increasing force, or something of that kind. I did not understand the question clearly. I would say that if the gentleman were standing here and I were to place my fist squarely against his head that would be the least pressure against the greatest resistance, and he would have no pain. If I were to press with increasing pressure until I forced the head to the shoulder it would be moving the head that distance painlessly. But if I were to haul off and strike him hard, giving the greatest force against the greatest resistance, he would find it a very painful operation. It is precisely the same with movements of the teeth. However, we are not here moving the teeth in the ordinary acceptation of the term in orthodontia. The bones are being moved in this operation, and I am sorry to say that just as soon as we get through with that we have to go back to the other mode. I only brought in an example to explain why it is that there is no pain along the suture. It is because it is moved in a gentle way.

Both Dr. Angle and Dr. Brady in their discussion, and another gentleman with whom I have talked, told me I had overlooked future development. Where have I overlooked it? Why shall there not be future development in my cases as well as where other methods are used? I know patients who have ceased to be mouth-breathers immediately; I know where slight adenoids have rapidly disappeared after this treatment. In cases where there is occlusion of the septum there is generally some hypertrophy of the septum. If we give these people an opportunity to get plenty of oxygen immediate improvement will begin, and development will be resumed.

This method is particularly useful in the treatment of young patients before

the cuspids and bicuspids have erupted at all, or when you have only the molars and the four incisors in the upper jaw of the permanent set. In a great many cases you can see that if nothing were done the teeth would come in out of line and the cuspids would be entirely outside of the line. I have taken such cases and by spreading the maxillæ apart I have obtained the increased space required, and all the teeth have come in in perfect alignment.

I think I am the only one who has been doing this work constantly and persistently for over fifteen years, and you cannot compare my results with accidental happenings in the practice of other men.

Dr. WATSON. Suppose you have a case where the esthetic requirements demand development of the mandible and retrusion in the upper, would you not use the upper jaw as an anchorage for the lower, to bring forward the lower? Where are you going to get anchorage to develop the lower jaw?

Dr. OTTOLENGUI. I did not claim that there are no operations in which you should not use the molars; I am speaking of cases where you can get along without that.

The paper was then passed.

The CHAIRMAN. We have now an important paper from a very eminent man who has come from far across the seas to talk to us today—a man who is well known, and I take great pleasure in introducing to you Dr. JOHN E. GREVERS of Amsterdam, Holland, who will offer a proposal for an international nomenclature for the various forms of malocclusion. His paper is entitled "Odontharmosis: A Classification of the Various Forms of Occlusion of the Teeth," as follows:

Odontharmosis: A Classification of the Various Forms of Occlusion of the Teeth.

By Dr. JOHN E. GREVERS, Amsterdam, Holland.

CARABELLI'S NOMENCLATURE.

AN attempt to classify the various forms of occlusion of the teeth has now and then been made, with, however, varying results. The first published classification was by Carabelli, who in his "Systematic Handbook of Dental Surgery" (Vienna, 1844) enumerated and described six forms. As the Latin language does not possess a word equivalent to "bite," Carabelli introduced the term "mordex," from *mordere*, to bite. He designated the normal bite as *Mordex normalis,* the edge-to-edge bite as *M. rectus,* the open bite as *M. apertus,* the protruding bite as *M. prorsus,* the retruding bite as *M. retrorsus,* and the cross bite as *M. tortuosus.*

This classification was undoubtedly a step in advance; yet it did not meet with the approval of his contemporaries, as we do not find it adopted in their writings. The reason for this is not far to seek, inasmuch as this system is not free from contradictions.

In his fourth group, *Mordex prorsus*, we find the protruding jaw defined, *i.e.* protrusion of the upper or of the lower jaw (Pl. XXVI, fig. 182, and Pl. XXVII, fig. 1); and in the next group, *Mordex retrorsus*, are collected cases which are known as edge-to-edge bite and also as protrusion of the lower jaw (Pl. XXVIII, fig. 2, and Pl. XXIX, fig. 1). These are definitions which do not conduce to a clear understanding of the subject.

In 1880 Oakley Coles read a paper before the Odontological Society of Great Britain on "The Deformities of the Upper Jaw: an Attempted Classification of Them." As his paper, however, treats only of the deformities of the upper jaw, we can leave his classification out of the discussion.

STERNFELD'S NOMENCLATURE.

Exactly forty-four years after Carabelli a book on the same subject was published by Sternfeld, "Bissarten und Bissanomalien" (forms of bite and anomalies of bite); and in 1891 the same author published an article on "Anomalien der Zähne" in Scheff's *Handbook of Dental Surgery.*

In the last-named article Sternfeld introduces a nomenclature which has for its basis terms employed in anthropology. He recognizes two classes of occlusion—a physiological or ethnological, and a pathological.

The first class, the ETHNOLOGICAL, comprises the following named species: (I) *Orthognathia dentalis:* Normal bite. (II) *Prognathia ethnologica:* Prognathism. The same condition exists here as in (I), with the difference that here the maxillary teeth have a forward direction. (III) *Orthogeneia ethnologica:* Edge-to-edge bite. (IV) *Progeneia ethnologica:* Protrusion of the mandible.

Under the PATHOLOGICAL forms of occlusion Sternfeld ranges the following: (I) *Prognathia pathologica:* Protrusion of the maxilla. (II) *Orthogeneia pathologica:* Pathological edge-to-edge bite—which he says is very rare. (III) *Orthognathia pathologica:* Pathological normal bite—which is also seldom met with. (IV) *Progeneia pathologica:* Pathological protrusion of the lower jaw; not rare. (V) *Opisthogeneia:* Retrusion of the mandible. (VI) *Opisthognathia:* Retrusion of the maxilla.

By combining two distinct forms of anomalies, expression can be given to certain sub-forms, *e.g.* a retrusion of the maxilla (opisthognathia) with a protrusion of the lower (progeneia), *i.e.* progeneic opisthognathism.

In general, Sternfeld applies the term "gnathia" for the upper and "geneia" for the lower jaw, and uses the prefixes "ortho-," "opistho-," and "pro(s)-" to indicate the position of the teeth, whether straight, backward, or forward.

This nomenclature would be acceptable if it could be proved that the pathological forms here given are exaggerations of the ethnological or physical forms, and moreover, that the ethnological forms also are indeed fixed and racial characteristics.

We believe that exception must be taken to the fourth ethnological group—*Progeneia ethnologica*—protrusion of the lower jaw. The facts brought forward to establish the existence of a physiological or ethnological progeneia are doubtful, to say the least.

Sternfeld cites as an example of ethno-

logical progenecia the ancient Frisians, and gives this on the authority of Virchow, who in his "Beiträge zur Physischen Anthropologie der Deutschen, mit besonderer Berucksichtigung der Friezen" (contribution to the physical anthropology of the Germans, with special reference to the Frisians), 1877, claims for the ancient Frisians protrusion of the lower jaw as a racial characteristic, and in support of his conclusions gives a few drawings of ancient skulls (pp. 178, 181, 289, and Pl. I and II). In the text, however, we find some passages which make it extremely doubtful whether the conclusions of Virchow are correct. On page 63, in describing two skulls belonging to the island of Marken, Virchow admits that they have "lower jaws which are fairly fitting;" again on page 63, "—discarding the lower jaw, which probably does not belong to skull No. 15 (Plate I, fig. 1);" and again on page 68, "The fairly fitting lower jaw (skull No. 16, Plate II, fig. 1) in regard to form and teeth disharmonizes so much in color and other appearances that it is doubtful if it belongs to the skull."

From personal study of these skulls I fully agree with Virchow, and do not hesitate to declare that the mandible does not belong to the skull, and that from these skulls it cannot be concluded that the Frisians were ethnologically a progeneic race. An ancient Frisian skull found in a "terp," in my possession, on the contrary, shows unmistakable evidence of orthogeneia ethnologica—edge-to-edge bite. From a trustworthy source I learn that the collection of skulls of ancient Frisians found in the provincial museum in Leenwarden show that the ancient Frisians had an edge-to-edge bite, and must in this characteristic be classified with the Egyptians and Celts, which Sternfeld arranges under class III. Of twenty-one skulls of ancient Egyptians measured by me in the anthropological museum in the Jardin des Plantes in Paris, I found six with normal bite (orthognathia dentalis), two with protrusion of the upper jaw, and thirteen with edge-to-edge bite.

It is therefore extremely doubtful that a protruding mandible is here an ethnological fact.

Moreover, the term "progeneia" is not a precise and definite one. This term —or "progenæa"—originated with L. Meyer ("Ueber Crania progenæa, etc.," *Arch. f. Psychiatrie,* vol. i, Nos. 1 and 2, 1868), who had found among the inmates of insane asylums typical cases of protruding mandible which were connected with a certain form of insanity, and to Meyer were pathognomonic.

By comparing the drawing which accompanies Meyer's article with the illustrations given by Virchow of protruding mandible we come to the conclusion that the two authors attach a different meaning to this term. Meyer's case shows a decided protrusion of the mandible—so much so that the lower front teeth bite in front of the upper ones, while in Virchow's cases they meet edge to edge. But we must not forget that the mandibles described by Virchow did not belong to the skulls to which they are assigned.

But a serious objection must be raised against the classification of Sternfeld, inasmuch as there is no room for that class of pathological occlusion of teeth which we call open and cross bites; and it is not improbably owing to this incompleteness that Sternfeld's system is not in general use by our profession.

A GOOD CLASSIFICATION A PRESENT NEED.

That a good classification is greatly needed now that the science of orthodontia is broadening and growing will be acceded to by every practitioner, and in particular by the teachers of orthodontia.

Angle, in the sixth edition of his "Treatment of Malocclusion of the Teeth," gives a good working classification. He divides the cases of malocclusion in three classes with divisions and subdivisions. Class I comprises the normal bite: Arches in normal mesio-distal relation. Class II: Protrusion of the maxilla: Lower arch distal to normal in its relation to upper arch. Division 1: Bilaterally distal, protruding upper incisors. Subdivision: Unilaterally distal, protruding upper incisors. Division 2: Bilaterally distal, retruding upper incisors. Subdivision: Unilaterally distal, retruding upper incisors. Class III: Protrusion of the mandible: Lower arch mesial to normal in its relation to upper arch. Division: Bilaterally mesial. Subdivision: Unilaterally mesial.

This system works well for studying the treatment to be instituted; it has, however, the great drawback that it does not include every variety of malocclusion and does not appeal to the imagination.

ISZLAY'S NOMENCLATURE.

We believe—and an extended experience has proved it—that we have an excellent and logical classification in that which was introduced by Iszlay in 1881 and 1891.

Before the dental section of the International Medical Congress held in London in 1881, Iszlay read a paper entitled "Illustrative Skizzen in Carabelli's *Mordex prorsus* und dessen Verhältniss zur sogenannten *Prognathia ethnologica* und Meyer's *Crania progenæa,"* in which the author proposes a new nomenclature for the forms of malocclusion.

Ten years later, in 1891, Iszlay published a short paper on the same subject in the Austro-Hungarian *Quarterly Journal of Dental Surgery,* which paper may be considered a revised and condensed edition of that which he read in 1881.

The nomenclature therein proposed, according to my experience, is not only correct, but is above all a highly practical one, which upon its once becoming generally accepted will be of great value in discussions, etc., conveying as it does a clear definition of each particular form of malocclusion.

To do away with a term which we all acknowledge to be incorrect—a misnomer—"articulation of the teeth," Iszlay proposes the term odontharmosis, from ὀδοὺς, tooth, and ἁρμοζεῖν, ἅρμοσις —joining, fitting.

Now, in order to be able to determine the variations in odontharmosis it is desirable to find a fixed or quasi-fixed point. For this purpose the upper teeth have been selected; in other words, the relation of the position of the teeth of the lower jaw to those of the upper. According to this position we may have the following chief forms:

(I) The front teeth of the lower jaw strike back of the upper teeth: Normal bite: *Enarmosis.*

(II) The front teeth of the lower jaw strike in front of the upper: Protrusion of the lower teeth: *Epharmosis.*

(III) The cutting edges of the lower teeth meet the same edges of the upper teeth: Edge-to-edge bite: *Prosarmosis.*

(IV) Between the upper and lower teeth there is an open space: Open bite: *Opharmosis.*

(V) The lower teeth cross the upper teeth: Cross bite: *Dicharmosis.*

(VI) The odontharmosis is mixed up: Mixed bite: *Tyrpharmosis.*

GENUS I. *Enarmosis* (ἐν ἁρμόζω): Normal bite. The teeth of the mandible strike back of the lingual surface of the upper teeth, leaving hardly any space between them, the teeth of the mandible being overlapped by those of the maxilla by one or two millimeters.

Species 1. The same relationship as preceding, with the difference that there is a greater distance between the labial surfaces of the lower teeth and lingual surfaces of the upper teeth: Protrusion of the upper teeth: *Di-enarmosis* (διὰ, away from).

Species 2. The same relationship as in species 1, with the difference that the lower teeth are here overlapped to a greater extent by the upper teeth: Deep bite: *Dys-enarmosis* (δὺς, wrong).

Both classes appear either separate or combined; in the latter case we have protrusion with a deep bite: *Dys-di-enarmosis.*

GENUS II. *Epharmosis* (ἐπὶ ἁρμόζω): Protrusion of lower teeth. Here the relationship between the lower and the upper teeth is reversed. The lower teeth stand in front of the upper and are overlapped by the upper teeth to the extent of one or two millimeters.

Species 1. The same as species 1, genus I, but reversed: Protrusion of the lower teeth, but being greater it is called *di-epharmosis.*

Species 2. The same as species 2, genus I, but reversed: Deep bite with lower teeth in front—*dys-epharmosis.* Where both species are combined we have more or less protrusion with a deep bite: *Dys-di-epharmosis.*

GENUS III. *Prosarmosis* (πρὸς ἅρμοσις): Edge-to-edge bite. It comprises those cases where the cutting edges of the lower teeth meet the cutting edges of the upper. (No species.)

GENUS IV. *Opharmosis* (ὀπὴ ἅρμοσις): Open bite. Here are included those cases where on closing the mouth the molars and premolars or the molars alone meet, leaving an opening between the front teeth. (No species.)

GENUS V. *Dicharmosis* (δίχα ἅρμοσις): Divided, cross bite. Characterized by a combination of the foregoing genuses; one side may be enarmotic, the other epharmotic, etc.

GENUS VI. *Tyrpharmosis* (τύρβη): Mixed bite. Here the odontharmosis is so mixed up that it cannot be grouped under any of the genuses enumerated, either in one or two combinations.

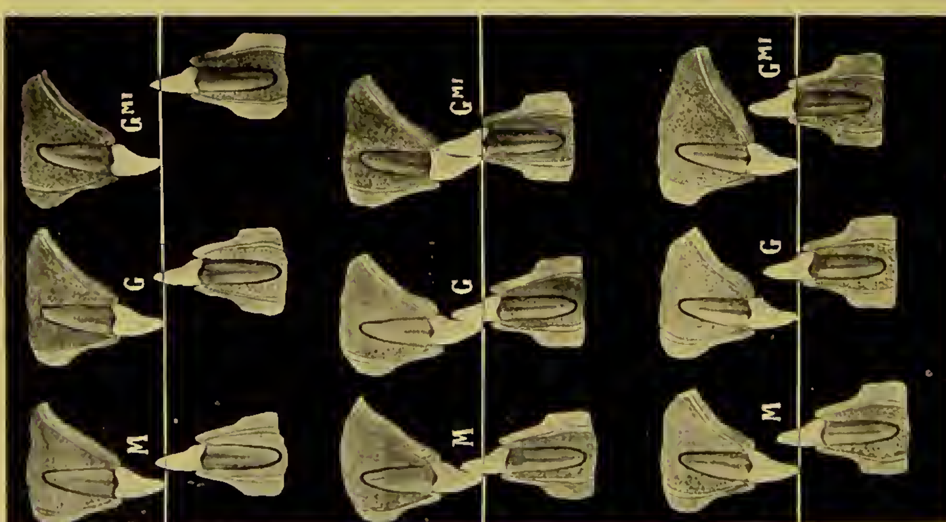
By critically studying this system it becomes evident that the two last-mentioned genuses cannot be admitted as such; that they are nothing else than combinations of the preceding groups; nevertheless the terms are practical.

The system of Iszlay as presented to us in 1891, and given above, did not work satisfactorily, it seemed to me, when applying it for practical purposes in various museums, failing to cover all cases of malocclusion and needing extension.

While visiting Dr. Iszlay in Budapest this incompleteness was pointed out, and we set about to remedy the objections that might be raised to a nomenclature otherwise so admirable. With the assistance of a large collection of lantern slides we came to the conclusion that the system needed to be developed, and

ENARMOSIS.

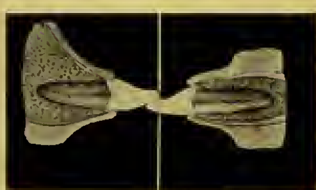
Di-enarmosis.



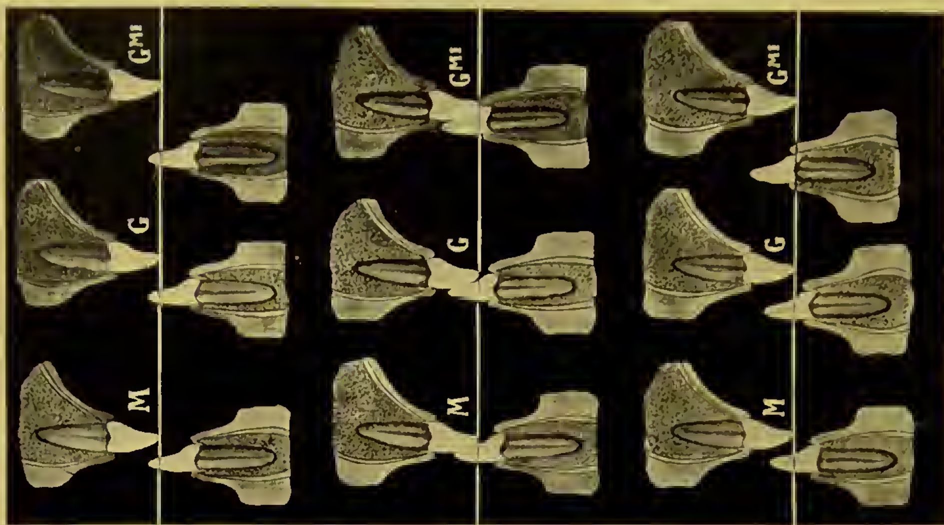
Dys-enarmosis.

Dys-di-enarmosis.

EPHARMOSIS.

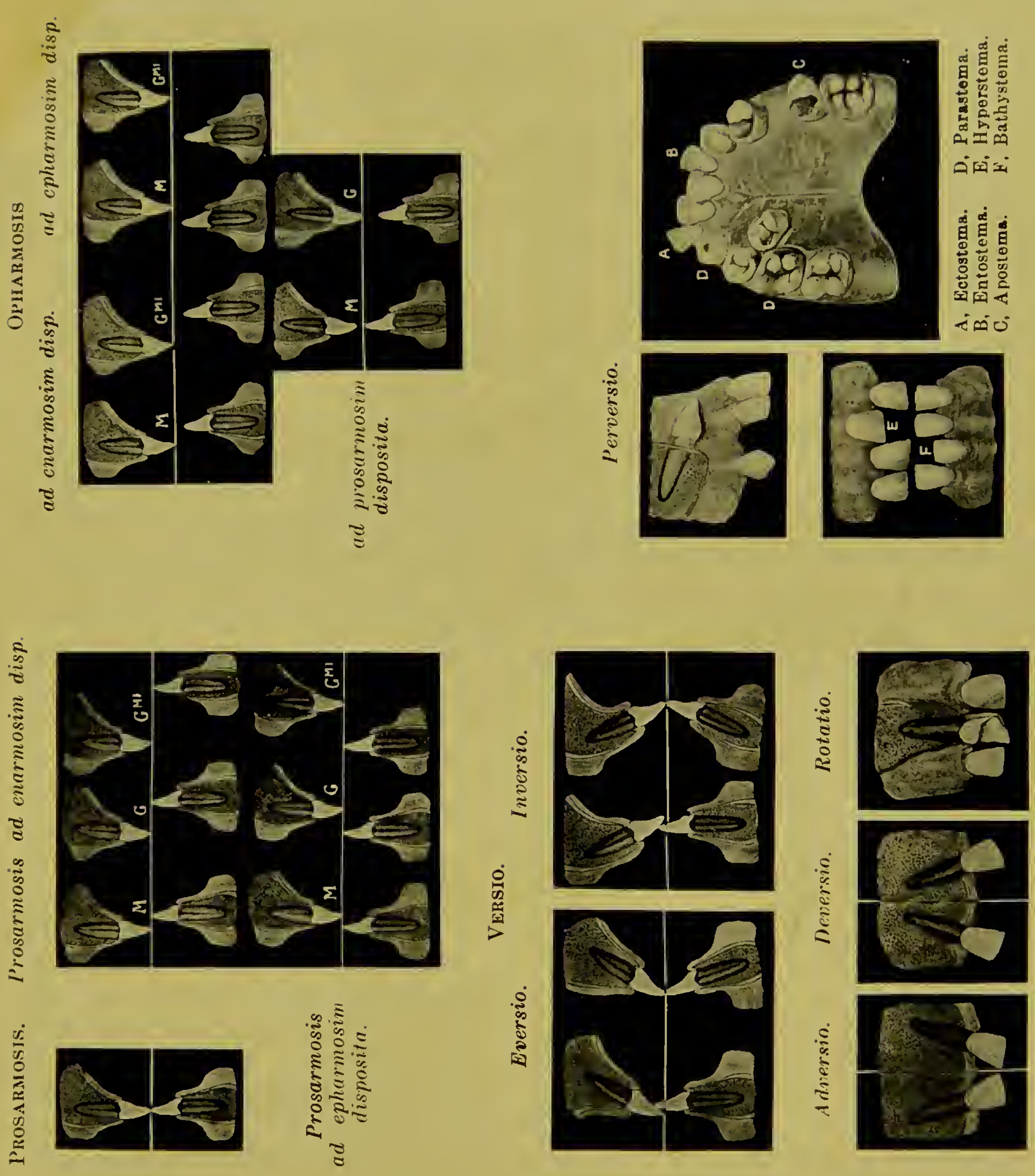


Di-epharmosis.



Dys-epharmosis.

Dys-di-epharmosis.



that this could be done without changing it as first proposed; and we found that we had in the first four genuses all the elements necessary to classify every form of odontharmosis by making a varied combination of these four groups.

The following classification is now proposed:

PROPOSED NOMENCLATURE.

I. Enarmosis.

(A) *Eu-enarmosis:* Normal bite.

(B) *Di-enarmosis:* Protrusion of upper jaw. (*Levis, mediocris, gravis, gravissima*.)

(C) *Dys-enarmosis:* Deep bite. (*Levis, mediocris, gravis, gravissima.*)

(D) *Dys-di-enarmosis:* Protrusion with deep bite. (*Levis, mediocris, gravis, gravissima.*)

II. EPHARMOSIS.

(A) *Eu-epharmosis:* Protrusion of lower jaw is minimum.

(B) *Di-epharmosis:* Protrusion of lower jaw. (*Levis, mediocris, gravis, gravissima.*)

(C) *Dys-epharmosis:* Protrusion (slight) with deep bite. (*Levis, mediocris, gravis, gravissima.*)

(D) *Dys-di-epharmosis:* Protrusion with deep bite. (*Levis, mediocris, gravis, gravissima.*)

III. PROSARMOSIS.

(A) *Prosarmosis simplex sive eu-prosarmosis:* Edge-to-edge bite.

SPECIES.

(1) *Prosarmosis ad enarmosim disposita.*

(2) *Prosarmosis ad epharmosim disposita.*

(3) *Prosarmosis ad di-enarmosim.* (*Levem, mediocrem, gravem, gravissimam.*)

(4) *Prosarmosis ad di-epharmosim.* (*Levem, mediocrem, gravem, gravissimam; disposita.*)

IV. OPHARMOSIS. (Open bite.)

SPECIES.

(1) *Opharmosis ad prosarmosim disposita.* (*Levis, mediocris, gravis, gravissima.*)

(2) *Opharmosis ad enarmosim disposita.* (*Levis, mediocris, gravis, gravissima.*)

(3) *Opharmosis ad epharmosim disposita.* (*Levis, mediocris, gravis, gravissima.*)

(4) *Opharmosis ad di-enarmosim.* (*Levem, mediocrem, gravem, gravissimam; disposita.*)

(5) *Opharmosis ad di-epharmosim.* (*Levem, mediocrem, gravem, gravissimam; disposita.*)

V. DICHARMOSIS.

VI. TYRPHARMOSIS.

In determining malocclusion it is of very great importance that a study be made of each particular case; that the relation of the lower teeth to the upper be closely examined; and, above all, that a study be made of the direction of the teeth. When this is neglected a wrong diagnosis will be the result and this system will not work.

Many cases classified as protrusion—or, as some call it, prognathism—are nothing else than cases of eversion (anteversion, Magitot), which has nothing in common with di-enarmosis or prognathism, and as a rule is the result of thumb- or tongue-sucking or other disturbing habit, by which the teeth are turned in the direction of their long axes; again, a deep bite through loss of the molars and premature extraction of the four first molars is often responsible for the eversion of the front teeth. Where we find eversion connected with an opening between the lower and the upper teeth we have an opharmosis with eversion of the incisors—cases which we often meet with in practice.

To eversion must be attributed what the French school of anthropologists terms *prognathisme alvéolo-sous-nasal.*

Discussion.

The CHAIRMAN. I am sure we are all very much interested in this subject. I am glad to know they have the same difficulties in Europe as we do here in trying to find short and comprehensive terms to describe teeth in the various forms of malocclusion. All of us who have struggled along these lines certainly can appreciate this very excellent paper of Dr. Grevers. Of course we cannot now estimate the true value of the paper. We must have time to think and reason over it, but I can see that it contains thoughts of much value. I will now call on Dr. A. H. Thompson to open the discussion.

Dr. A. H. THOMPSON, Topeka, Kans.

I regret that I did not hear all of the paper, but I was much impressed with what I did hear, and I am quite pleased with the classification that Dr. Grevers has given us, and especially in the matter of nomenclature, to which I have given some study. Orthodontia is one of the newer branches in which we are eminently in need of a more comprehensive nomenclature, and it seems to me that the suggestions of Dr. Grevers are in that direction.

There is one point that has been referred to, the matter of abrasion, to which I want to make a contribution, and that is in regard to edge-to-edge occlusion. I have examined hundreds of skulls of Peruvians and Mexicans and made examinations in regard to dental ethnology, and I find invariably this abrasion that is attributed to edge-to-edge wear. I have also found in most Europeans that are tobacco chewers a great deal of edge-to-edge abrasion. Some old tobacco worm who has chewed almost continuously for forty years or more will almost always exhibit this occlusion, and my idea is that it is the wearing away of the cusps that leads to the protrusion of the mandible (in that way bringing about edge-to-edge occlusion and abrasion) as well as the vicious habit of reaching out as the edge becomes worn, so there is a still greater tendency to bring the jaw forward. Among the ancient races I have observed there was not this edge-to-edge occlusion among the young and children. I have noticed that among the Peruvians and Mexicans there is not the edge-to-edge occlusion among the young people. I make this as a contribution, not a criticism. So far as my observation goes, among the apes there is no edge-to-edge occlusion except when there has been incessant wear. In the gorilla and chimpanzee class there is edge-to-edge occlusion where there is wear. As a rule, unless there is wear there is not this edge-to-edge occlusion. So my opinion is that the edge-to-edge occlusion has been brought about by excessive mechanical abrasion.

You will notice in some of the cases illustrated of what we call "jumping the bite," there is a sliding forward of the lower jaw.

Dr. Grevers (closing the discussion). I thank the gentlemen for their remarks and I appreciate the criticisms made. I recognize that in this nomenclature the etiology is a quantity or anatomical relation that is neglected.

It was moved that a standing vote of thanks be tendered to Dr. Grevers for his paper. The motion was carried and a rising vote of thanks tendered.

Dr. Grevers in response referred to his colleague who prepared the plates and cuts shown, and asked that the thanks of the section be also shared by him, stating that with the consent of the section he would convey them to him.

The Chairman. One of the hopeful signs in the field of orthodontia is that a type of men are becoming interested who are broad-minded and thoughtful, and who are not content to confine their studies to the much-threshed, petty, insignificant regulating-appliance corner of this field, but are reaching out in their researches into those questions which have a broad yet direct bearing on the practice of orthodontia. It is with much pleasure I introduce to you the next speaker, Dr. José J. Rojo of the City of Mexico, Mexico, who will speak to us on the etiology of anomalies in human teeth.

The paper was as follows:

An Etiological Study of Some Anomalies in Human Teeth.

By Dr. JOSÉ J. ROJO, City of Mexico.

Orthodontia is an interesting branch of surgery, and as the mother science progresses new specialties are born in obedience to a law that has been enunciated by Auguste Comte, who says that: "By a law whose necessity is self-evident, every branch of science insensibly separates itself from the main trunk as soon as it has acquired sufficient development to support an isolated culture; that is to say, as soon as it has reached a point where it can in itself occupy the permanent activity of certain intelligences."

The work which I have the honor to present to you is of the character of a study especially founded on the etiology of the dental anomalies of position, as these doubtless mostly occupy the mind of the orthodontist.

Magitot was the first to classify the dental anomalies of mankind, but did so in too extensive a manner. Later on, Professor Dubois accepted Magitot's classification, simplified it in part, although he introduced nine new forms together with their subdivisions. I believe that this classification can be still further simplified by placing the cases in the order of frequency, as follows:

	Classification of Dr. Angle.	
(1) Anomalies of position	Class I.	Arches in Normal Mesio-Distal Relations.
	Class II.	Division I. Subdivision. Division II. Subdivision.
	Class III.	Division. Subdivision.
(2) Anomalies of eruption		Delayed. Premature.
(3) Anomalies of number		Increase. Decrease.
(4) Anomalies of form		Partial. Total.
(5) Anomalies of structure		Partial. General.
(6) Anomalies of jaws		Retrusion. Protrusion.

Etiological studies are from their very nature difficult to explain, and for this reason perhaps it is that we frequently find apparent deficiencies on this point in text-books on the subject. These difficulties may be illustrated by the following example. If we take a vessel full of water and abandon it to a group of persons in order that each one may pour into it a drop of a different substance, and afterwards we try to find out to what element that water owes its altered color, it will be almost impossible to discover. It is a very difficult matter, and on the other hand probably of little practical utility from the surgical point of view; but if we were to neglect our etiological studies we would soon be reduced to the position of mere mechanics, and there would be no difference between the blacksmith who hammers out bars of steel and the surgeon who puts into their proper places the delicate dental organs.

Let us therefore endeavor to discover the immediate causes of dental anomalies. The causes that have been unanimously accepted are two—the *accidental and mechanical*, and the *hereditary*.

The accidental and mechanical causes are unquestionably those that have produced the greatest number of anomalies, especially those of class I under the Angle classification, but nevertheless they accidentally give rise to the misplacements of classes II and III.

From the original structure of the anterior part of the maxilla, which at one period is formed of four distinct cellular groups, we can easily suppose that on account of its greatly complicated circulatory network it is more frequently exposed to the accidents of nutrition and evolution, and thus we can explain why it is that the upper incisors are those that more especially suffer the consequences of altered functional activity.

Accidental diseases, such as meningitis, eruptive fevers, anemia, chlorosis, etc., which work by debilitating the system of the child and arresting development, are the principal causes of the anomalies of eruption, and these in their turn give rise to the greater part of the cases of anomalies of position.

The mechanical causes consist of extractions or premature loss of the dental organs, whether of the temporary or of the permanent set, the delay in the shedding of the temporary teeth, the delay or prematureness in the eruption of the permanent teeth, all of which causes give rise by a simple mechanical effect to the formation of numerous anomalies of position.

External forces, such as the muscular pressure of the bony frame of children, the habit of biting hard bodies with the front teeth and occluding the mandible in a forced position, also form part of the group of accidental or mechanical causes.

In these cases, the persons who suffer from dental anomalies are healthy, and though their development has been partially altered it may be said to be normal; the teeth present no indications of hereditary disease, and the misplacements are generally confined to these without greatly affecting the bodies of the jaws or the physiognomy.

The dental deformities that are caused by heredity are those that present the greatest difficulties in forming conclusions; but notwithstanding that a multitude of anomalies can be attributed only to these causes, it is necessary to study them with special care.

The causes at work during intra-uterine life may be divided into two classes: *heredo-physiological* and *heredo-pathological.* The introduction of new scientific terms requires that they should represent a clear and precise idea of the subject to which they refer, and by the term heredo-physiological it is my intention to express certain aspects that are hereditary and at the same time cannot be attributed to any pathological cause. The term heredo-pathological expresses the idea that any given pathological condition in a system is hereditary.

The dental malformations that proceed from physiological heredity are those that are transmitted from generation to generation and that do not reveal by any special indication that they might be considered pathological traces, but that only appear to reveal a certain condition of life in certain individuals. Among these anomalies we may mention the following: Prognathism peculiar to certain races and which in this case cannot be considered as an anomaly; the tendency to have one or more teeth slightly crossed or twisted, especially the upper central and the lateral incisors. Other causes arise from family tenden-

cics, by which the upper right or left lateral remains in distal occlusion. This classification also includes any supernumerary tooth, or the absence of one or more teeth, especially of the upper laterals.

The theory that for some time has been sustained, that the crossing of races was one of the causes of misplacement, is a theory hardly sustainable, principally through physical disproportion of the progenitors. That when one of the progenitors has a large frame with large-sized teeth set in large jaws and the other has a small frame with comparatively small jaws and teeth, the child may inherit the large teeth of one and the small jaws of the other, I consider ought to be entirely disregarded in our discussions, as we frequently observe among our patients that children with marked dental anomalies are frequently born of physically well-proportioned parents; and on the other hand the laws of biology would not give to one being a right arm of sixty-one centimeters with a left arm of fifty centimeters, except in the case in which a superior force—such as a morbid diathesis—caused such disproportions.

The individuals who present the heredo-physiological anomalies are generally perfectly constituted and developed; the structure, color, and form of their teeth are normal, and do not reveal the presence of any pathological diathesis in their organism. The anomalies from which they suffer will almost exclusively come under class I, and only accidentally under classes I and II.

The anomalies caused by pathological heredity are very frequent, and, unfortunately, for a very natural reason, are the most difficult to explain. Patients thus afflicted usually conceal the nature of the disturbances with which they are afflicted. On the other hand, through the want of exact external indications which would reveal either in the progenitors or in their descendants a present disease or the traces of an old disease, the practitioner often finds it impossible to diagnose with certainty the hereditary influence that has given rise to the particular anomaly.

Alcoholism, scrofula, syphilis, and nervous diseases are the principal morbid processes that give rise to dental anomalies through pathological heredity.

The children of alcoholic, scrofulous, and insane persons, or those suffering from nervous affections, are generally children of poor or degenerate constitution, weak and of deficient vitality, and who, through factors which do not act directly on the buccal organs but on the general system, have a great propensity to suffer from anomalies of eruption, and the latter in their turn produce numerous anomalies of position. Their weak health explains everything; the physiological functions are altered and the whole system suffers. The anomalies that are most frequently found in these persons come under classes I and II; the latter probably through a relaxation of the muscles or articular cartilage of the temporo-maxillary articulation or else through the fact that the bony structure of the mandible is better able to resist the pathological influences.

Lombroso calls attention to the presence of certain anomalies in criminals, in his work "The Criminal Man" (pages 242 to 248, vol. i).

Syphilis is unquestionably the most injurious morbid affection of the human system and may be considered as the direct cause of a great number of dental anomalies.

If we examine the mouths of congenital deaf mutes, of blind, of insane, and criminal persons, we will be astonished at the fabulous number of dental anomalies which we will discover in those persons. On the other hand, we will find that the principal causes of these congenital affections are syphilis and alcoholism.

In his masterly treatise on "Latent Hereditary Syphilis" Fournier presents the clearest evidence of the anatomo-pathological effects of hereditary syphilis on the system.

Hutchinson, to whom Fournier as well as all familiar with his work render due homage, was the first to point out the influence of hereditary syphilis on the production of dental anomalies of structure, and it is due to this fact that in a great number of text-books the name of Hutchinson teeth is given to those that appear as though they had been cut out on the cutting edges, a characteristic that in many cases originates from hereditary syphilis.

Besides these anomalies, Fournier presents us a multitude of other malformations, such as dental erosions, *cupule, facettes, sillon nappe,* dental amorphism, vulnerability of the dental system, giving as principal causes a delay in the evolution, and modification of structure.

Among the classes of erosion described by Fournier we find cross stains in the upper incisors indicative of hereditary syphilis, and we could attribute to the same pathological cause the production of those whitish stains frequently found associated with certain anomalies in the dental system, as well as other specific indications. These stains which represent a form of anomaly in superficial structure are frequently noted in children absolutely free from syphilitic diathesis, as can easily be proved by the entire absence of the specific syphilitic indications.

Hutchinson, Jackson, Lewin, Klink, Duncan, Bulkley, Lange, and many others confirm the influence that is exercised on the system by hereditary syphilis giving rise to rickets or degeneration, or to what Fournier so expressively calls "syphilitic infantilism;" and as a natural consequence, this gives rise to the anomalies of eruption, producing also anomalies of position, both through a morbid as well as a mechanical effect.

In studying the anomalies in the cranium, nose, and limbs, we find that Hutchinson, Fournier, Lange, Debove, Moynac, and many other pathologists have frequently observed cases of hereditary syphilis in their respective clinics. Fournier classifies the anomalies in the cranium as follows: "Olympic forehead; forehead with lateral eminences; lateral protuberances; asymmetry in the cranium and hydrocephalic cranium;" deformities of the nose, the organ being larger or smaller than normal either through faulty development or loss of substance by local accidents, while the lower limbs also present frequent deformities.

It is evident that heriditary syphilis is the principal cause of those serious attacks on the skeleton producing among others the anomalies of an Olympic forehead, broken nose, twisted limbs, etc. We do not hesitate to include among these anomalies those of the jaws and the very pronounced ones of dental malocclusion, as only a powerful cause like syphilis can give rise to those buccal monstrosities that constitute to a great extent the anomalies under the subdivisions of classes II and III. Through the tendency of the Hutchinson teeth to assume an oblique and convergent position,

we can well suppose that this frequent misplacement, which Professor Guilford has designated by the name of "lancet arch" and "constricted arch," is likewise of syphilitic origin.

It would be absurd to claim that hereditary syphilis is the only cause and that to it are due all of a certain type of anomalies, and at the same time it would be a crime to brand innocent persons who without any syphilitic cause whatever suffer from certain anomalies. As a matter of fact, there are many children that come to ask our good offices as orthodontists who present absolutely not the slightest trace of syphilis.

On the other hand, we find that the children of syphilitic parents, as an exception, do not present anything more than slight traces of the lues of their parents, and we also see children in whom we find certain evidences of hereditary syphilis both in their general constitution as well as in their teeth, in whom nevertheless their jaws and teeth occlude in the correct way; and their bony system does not as a rule present any important anomaly. But at the same time, these exceptional cases must not lead us to forget that all or almost all those who have inherited syphilis present one or more dental anomalies, especially those in classes II and III.

Let us now see what the cellular doctrine says. "Every organism, whether animal or vegetable, represents in the last case either isolated cells or associations of cells. The ovule is a simple cell, and from more or less transformed cells we find resulting the tissues that are farthest in appearance from the cellular type, such as the bony tissue, the vascular tissues, etc.

"The cells are miniature organisms endowed with lives of their own and charged with the fulfilment of a special action in the vast federation of the bodies of plants and animals. However elevated and complex we may suppose the function of an organ, it is always the result of the partial work executed by the cell."*

The morbid agents work in the cells of the human system, both chemically and mechanically; their influence will produce death, or the partial destruction of cells, or the atrophy or destruction of the vesicles that carry the vitality, producing a want of volume in a given region either through the absence of substance or faulty development. By a natural law, if during the period of development we find a region that does not demand physiological force, it is very probable that the region which absorbs the unused vitality of the neighboring region will develop more than it would if the vitality were distributed in all parts, and would thus produce a greater contrast between the paralyzed or atrophied region and that which is developed or hypertrophied.

Among the morbid processes that are transmitted by heredity, syphilis is that which exercises the greatest destructive power on these cells. If the syphilitic virus is introduced into a healthy organism it attacks and destroys it and partially kills it by the destruction of a multitude of cells, and terminates by poisoning the entire system, manifesting itself at every opportunity. If unfortunately the evil continue it will exercise its toxic influence upon the embryo, often leading to pre-natal death. If the embryonal cells are not altered by a scrofulous, lymphatic, or other diatheses, the embryo comes out triumphant from the

* S. Ramon Cajal, "Treatise on Histology."

struggle but with more or less debilitated constitution. Struggling they may reach the age of puberty and be capable of procreating, giving rise to modified or attenuated manifestations that may vary to an infinite degree. In these heredities of the second degree and in the subsequent ones we will find the dental anomalies difficult to diagnose. Perhaps from generation to generation, and after a multitude of cellular struggles, the virus disappears entirely—not, however, without having induced deformities or degenerations of varied degrees of intensity.

It is difficult to establish a correct prognosis of the variations that may be assumed by these affections in the third, fourth, or fifth generation, but we can safely assert that the vigorous organism, with well-balanced cellular structures, such as that of the Aztec Indian race and others, will better resist these pathological attacks. On the other hand, we will find that either through the increasing efficiency of medical treatment or through the attenuation of the disease in the new generations, its ravages will probably be greatly mitigated.

I must remind you that the present paper is only a study, and that it will be the duty of those who are interested in this important branch of medicine to devote their attention to it in order to throw more light on some of its most interesting points.

Discussion.

Dr. A. H. Thompson, Topeka, Kan. I was very much interested in the paper of Dr. Rojo's. He has presented in a very striking way many of the elements that contribute to the science of orthodontia, but I am scarcely capable of discussing the paper because I am not an expert myself.

I was much impressed with what he said in regard to some of the more prevalent constitutional diseases of civilization; his theory of the effect of malnutrition or lack of nutrition is very interesting. We know that certain diseases cause maldevelopment, but we do not know the intermediate steps; we do not know why certain conditions of malnutrition should cause that effect; we do not know the causes that affect the nerve supply or induce lack of development. There is a great gap to be filled in that particular point bearing on cause and effect; why the diseases should affect the nerves and cause degenerative evolution is something we do not understand.

In regard to syphilis, in countries where it prevails I think it will be gradually eliminated. Nature tends in the process of evolution to abort the things that are injurious; the diseased will perish, so there will probably be a practical lessening of the effects as it is weeded out and gradually eliminated, assisted as it will be by sanitation and improvement along the lines of hygiene. It is so in this country. There are certain races in which a disease prevails—and prevails to a great extent—from absence of hygienic care; this condition will be improved by education and sanitation.

Dr. F. M. Casto, Cleveland, O. I cannot agree with the author upon many points. We must all agree that the etiological study of dental anomalies is difficult and complex, but by the natural law of evolution, by close observation and

study, some of our most eminent men have made many points clear.

Dr. Rojo states in his paper, "Two are the causes that have been unanimously accepted, namely, (1) accidental and mechanical, and (2) hereditary." This statement I fear is only too true. I think in nearly all works published on the subject we find just such a division. I accepted this theory quite philosophically, and when a case of malocclusion presented if no cause was made conspicuous by the long retention of deciduous teeth, the extraction of permanent ones, or some other cause equally easy to determine, I was quite willing indeed to credit it on the hereditary side of the ledger, especially after having been assured by the parent that when she was a child her teeth were exactly the same but all evidences were lost by reason of the cracked teeth having been extracted and artificial ones substituted, or that the father, who was at that particular time in some distant country, had a cracked tooth identically the same. So I went on like hundreds of other men, crediting everything to heredity that I couldn't find an accidental or acquired cause for, until I came under the instruction of Dr. Angle, when my views were materially changed. He taught us to give heredity all credit due it, just as we would any other cause, but he was quite unwilling that we should divide the etiology into two general classes. He gave us the following etiological causes:

(1) Early extraction of deciduous teeth;
(2) Long retention of deciduous teeth;
(3) Extraction of deciduous teeth;
(4) Tardy eruption of deciduous teeth;
(5) Adenoid vegetations or nasal obstruction causing mouth-breathing;
(6) Accidents;
(7) Large tongue;
(8) Abnormal frenum labium;
(9) Heredity;
(10) Habits;
(11) Disuse;
(12) Supernumerary teeth;
(13) Abnormal lip pressure;
(14) Diseases interfering with normal development.

I wish to take exception most decidedly to the author's statement that cases of malocclusion resulting from acquired causes always present practically normal development without involving to any appreciable extent the bodies of the jaws or the physiognomy. Take, for example, a case of class II, 1st division, Angle classification: This case is characterized by distal occlusion of the lower arch; contracted upper arch; protruding upper incisors; sub-development of the mandible; atrophy, or lack of development of the upper lip (caused from its being practically out of function); hypertrophy of the lower lip (due to its being continually caught between the teeth, and bitten); mouth-breathing; poorly developed nares, and all the accessory cavities, namely, the maxillary and frontal sinuses, ethmoidal and sphenoidal cells, the muscles of the cheeks drawn and the child in many cases presenting a decided idiotic expression. The experience of close observers along this special line is that after obtaining a complete history and making a thorough examination most cases belonging to this class as well as in class III were due to local or acquired causes and not to heredity. Certain localities are conducive to certain forms of malocclusion; for instance, there is a prevalence of catarrhal affections around and in near proximity to the Great Lakes, and I am informed by Drs. Watson and

Barnes, of Detroit and Cleveland respectively, that a large percentage of the cases coming under their observation belong to class II, Angle classification. Now then, if a child is subjected to such climatic conditions and environments, and develops a catarrhal trouble or adenoid growths, causing it to become a mouth-breather, which results ultimately in a case of malocclusion (class II), and granting that its progenitors were mouth-breathers from the same cause, could we call it heredity? I say, no—most emphatically, no! Again, under the heredo-physiological class the writer claims that heredity so finely asserts itself as to cause very frequently central or lateral incisors to assume a "special form that forces them into a twisted position, while other cases arise from the family tendencies by which the upper right lateral remains in distal occlusion, or one of the teeth becomes superimposed or crossed."

I don't believe this claim can be satisfactorily proved. I have heard other men make this same statement and cite cases that had come under their observation; but I have as yet to see the first one "deliver the goods" in substantiation of the claim. I am convinced that a proper examination of such cases would reveal the fact that an exceedingly large percentage of them are due to acquired causes. Usually such meager forms of malocclusion are only symptoms of the real trouble. As I stated before, I believe that heredity plays some part in the etiology of dental anomalies of position but not so much as to be considered *one* of two great causes.

We quite agree that children born under the baneful influences operative in the heredo-pathological class, as described by the author, would probably possess a poor or degenerate constitution, and no doubt all the organs of the body would be more or less affected. The general physiological function would be interfered with and we might expect as a result almost any kind of an abnormality, certainly in the jaws and teeth as well as in other parts of the anatomy.

Hyde defines syphilis as a general infectious disorder transmitted from one individual to another by both contact or inheritance, involving one or several organs of the body, due to the toxic effect of the invasion of the bodily tissues by a morbid germ, the identity of which has not as yet been completely established.

By *infection by heredity* we mean that the disease is transmitted from the mother to the child *in utero,* and that the mother has been infected previous to fecundation; it seldom if ever occurs that the child is infected from the father alone. The theory heretofore generally accepted, that the disease manifests itself in the second or third generation, is disproved greatly by a series of investigations made by eminent specialists, who claim in nearly all cases a thorough history of the case resulted in the discovery that the child of the first generation either acquired the disease just previous to birth (the mother having been infected about the same time) or soon after birth from one of the many modes of infection.

The presence of the Hutchinson teeth when associated with parenchymatous keratitis and the scars of former fissures at the angle of the mouth are considered by many as pathognomonic of inherited syphilis.

The CHAIRMAN then called for further discussion of the paper, and no one

responding, it being very late he called on Dr. Rojo to close the discussion.

Dr. Rojo in closing the discussion thanked the section for the manner in which his paper had been received, and said he would not try to comment on any of the remarks that had been made, as he was not sufficiently well versed in the English language to express himself intelligibly.

The Chairman announced that the session would begin tomorrow at 2 P.M., when a number of interesting papers would be presented.

The meeting then adjourned.

SECTION VI—Continued.

FOURTH DAY—Thursday, September 1st.

Dr. M. T. Watson, the secretary, called the meeting to order at 2.25 p.m., and made the following statement:

I am sorry to announce that Dr. Angle is not feeling well this afternoon. He has gone to take a little rest and will try to be back here later; he has asked me to preside in his absence. Dr. Pfaff has asked that an explanation be made in regard to his paper. He was informed that there would be someone here to translate foreign papers, but unfortunately there has been no provision made for making such translations, so he will read a *résumé* of it in German.

Hofzahnarzt W. Pfaff of Dresden, Germany, then read in the German language a *résumé* of his paper on the "Development of Diagnostie and Therapeutic Methods in Orthodontia, and the Importance of the Etiology."

The paper in full here follows:

Ueber die Entwicklung der diagnostischen und therapeutischen Methoden der Orthodontie, und die Bedeutung der Aetiologie der Irregularitäten für die Behandlung.

Von Hofzahnarzt WILHELM PFAFF, Dresden, Germany.

Die Aufgabe, die ich mir gestellt habe, erblicke ich nicht darin, dass ich einen vollständigen Bericht über die gegenwärtig bekannten diagnostischen und therapeutischen Massnahmen gebe. Denn selbst, wenn ich Ihre Geduld ganz ungebührlich in Anspruch nehmen wollte, würde die Zeit in keiner Weise dazu ausreichen. Ich glaube, dass bei einem solchen Thema vieles als bekannt vorausgesetzt werden kann, und deshalb nur manches angedeutet zu werden braucht, um sofort volles Verständnis zu finden. Auch die Frage nach den Entstehungsursachen der Irregularitäten werde ich mit Verzicht auf jegliche eingehende inhaltliche Erörterung darstellen, wesentlich nach formalen Gesichtspunkten geordnet und nur in grossen Zügen.

Es erschien mir aber nicht unrichtig,

gerade in der gegenwärtigen Epoche und gerade vor einer solchen Versammlung, einmal Zeugnis abzulegen von der Entwicklung der Orthodontie des jüngsten Zweiges der Zahnheilkunde.

Während in früheren Jahrhunderten die Wissenschaft nur langsam fortschritt, hat das Jahrhundert der Dampfkraft und der Elektrizität den Stempel nervöser, überhastender Tätigkeit auch dem Fortschritte der Wissenschaft aufgedrückt. Namentlich die Entwicklung der naturwissenschaftlichen Disziplinen, aus denen wir schöpfen, gleicht mehr der einer modernen amerikanischen Stadt, die in wenigen Jahrzehnten vom Dorfe zur Millionenstadt wurde. Alle experimentellen Wissenschaften sind in den letzten Decennien derart in die Breite gegangen, dass viele, wie z.B. die Medizin, spezialisiert werden mussten. Gewiss ist eine derartige Arbeitsteilung dem raschen Fortschritte der Wissenschaft enorm förderlich, aber sie birgt auch nicht zu unterschätzende Gefahren in sich, da der unerlässliche Ueberblick über das Ganze zuleicht dabei verloren gehen kann. Um diesem Uebelstande nach Möglichkeit abzuhelfen, ist es Aufgabe der Kongresse zusammenzufassen und den in den Einzelheiten verirrten Geist wieder neuen allgemeinnen Gedanken und Zielen zuzuführen. Dadurch, dass wir bei unsern fachwissenschaftlichen Kongressen unsere Erfahrungen zusammentragen und uns mündlich darüber aussprechen, tragen wir nicht nur zur Lösung gar mancher wichtigen Frage bei, wodurch wir unser wissenschaftliches Material erheblich vermehren, sondern wir empfangen auch Anregungen zu neuen Aufgaben.

Mit Rücksicht darauf dürfte es für uns Spezialisten von Interesse sein, unsern Blick zurückzuwerfen auf frühere Entwicklungsperioden unserer Wissenschaft. Auf diese Weise lernen wir die Hilfsmittel kennen, die zur Bewältigung der Aufgaben dienten und schöpfen Stoff zu neuen Anregungen aus den grundlegenden Arbeiten vieler Forscher und Praktiker, durch die unsere Kenntnisse sich stetig erweiterten und vertieften. Auch bleibt so vermieden, dass das Gute und für immer Brauchbare, das nach meiner Ueberzeugung in vielen alten Methoden enthalten ist, einst zum zweiten Male entdeckt wird und das wäre ja nicht der erste Fall dieser Art in unserer Wissenschaft.

Die Grundgedanken einer Regulierungstechnik verlieren sich in die Anfänge des vorigen Jahrhunderts. Es fehlte jedwede tiefere Kenntnis der Entstehungsursachen von Unregelmässigkeiten oder der Physiologie der Gewebe und deren Veränderungen beim Richten der Zähne. Man hatte auch keine Ahnung, auf welche Art der Knochen beim Richten der Zähne jeweils mit der Ausbildung einer entsprechenden Architektur reagiert. So musste man sich darauf beschränken, primitive Apparate zu konstruieren, um lediglich aus kosmetischen Gründen kleinere Unregelmässigkeiten auszugleichen. Aber der Erfolg war minimal.

Die Anfänge einer Regulierungs-mechanik, d.s. die Forschungen nach dem Wirken der Kräfte, reichen nicht sehr weit zurück. Einen um so merklichen Fortschritt hat aber die Neuzeit zu verzeichnen.

Als Erfinder der leitenden Gedanken bei der Konstruktion unserer Apparate müssen angesehen werden in England: Hunter und Fox, in Frankreich Schanze und Lachaise, in Amerika Dwinelle, Kingsley und Farrar, und in Deutschland Linderer und Carabelli. Ohne nun auf

die historische Entwicklung der Richtmaschinen im einzelnen einzugehen, ist es Pflicht, die Begründer unseres Spezialgebiets nicht mit einem blossen Hinweis auf sie abzufinden.

Hunter legte als erster Kappen über die Zahnreihen zur Sicherung der Lage für die angebrachte schiefe Ebene. Fox erhöhte den Biss, um bei der Progenie die Ebene des Unterkiefers hinter die des Oberkiefers bringen zu können.

Bei Schanze bestand die Basis der Richtmaschine aus einer Reihe von Klammern oder fortlaufenden Bändern, an die ein labialer Bügel angelötet war, der dem normalen Kieferbogen entsprechen musste. Der Bügel hatte den Zweck, Zähne vermittelst Ligaturen nach auswärts zu bringen. Um Zähne nach innen zu bewegen, versah Schanze den labialen Bogen gegenüber den zu bewegenden Zähnen mit Loch und Gewinde und konnte so mit Schrauben einen Druck auf die zu bewegenden Zähne ausgüben. Auch verwendete Schanze zum Herausdrängen einzelner Zähne eine Bandfeder, die an den Bändern angelötet wurde und teilweise als Hebel wirkte. Die Schanze'sche Richtmaschine ist nach Walkhoff als der Grundtypus der Wirkung von Kräften auf einzelne Zähne aufzufassen.

Lachaise benutzte für das Zurückziehen der Vorderzähne ähnliche Bänder wie Schanze, nur liess er bei seiner Maschine quer über den Gaumen ein diesem anliegendes breites Metallband gehen, das als Vorläufer der Gaumenplatte aufgefasst werden kann. Als Kraft benutzte er die Elastizität eines Kautschukstreifens, der den Vorderzähnen straff anlag und an den Bändern befestigt wurde.

Auch Linderer verwandte Bänder als Basis für seine Apparate, nur legte er zum Zurückdrängen statt eines elastischen Kautschukstreifens einen Metallbügel über die Vorderzähne. Ein Rutschen des Bügels längs des Zahnfleisches verhütete er durch geeignete über die Zähne übergreifende und an den Metallstreifen angelötete Zungen. Den Bügel bewegte er anfänglich mit Ligaturen, später mit Schrauben. Carabelli verdanken wir das Arbeiten der Apparate nach Modellen. Er schuf ein System zum Bewegen von Zähnen, das ähnlich wie bei Farrar in einer Anzahl von Klammern und Bändern um Molaren und Prämolaren bestand. Ein lingualer resp. labialer Bügel verband die rechts- und linksseitigen Bänder und enthielt die Gewinde für Schrauben, die die Zähne vor- oder zurückdrängen sollten.

Unabhängig von den europäischen Regulierungsmethoden entwickelten sich die amerikanischen. Dwinelle wandte als erster in Amerika die Schraube an. Wichtiger noch sind Kingsleys-Arbeiten, die für uns in zweifacher Weise in Betracht kommen: 1) der Erkenntnis theoretische Teil derselben. Kingsleys Theorie über die Entstehungsursachen der Zahn Anomalien ist für uns auch heute noch in vieler Beziehung massgebend. Seine Untersuchungen über die Unregelmässigkeiten der Zähne und die Idiotrie hatten wichtige Ergebnisse. Seine Theorie über die physiologischen Veränderungen der Knochengewebe ist genügend bekannt, ebenso seine Theorie der Reguliernngsmechanik.

Was 2) den Spezialpraktischen Teil anlangt, so ist auch auf diesem Gebiete Kingsley kompetent. Die orthodontische Praxis verdankt ihm eine bedeutende Bereicherung an sehr zweckmässigen Apparaten, die zum Teil noch heute Anwendung finden. Er gab auch eine der bedeutendsten Monographien über Regulierungen von Irregularitäten heraus.

Eins der sinnreichsten, aber kompliziertesten Systeme verdanken wir Farrar. Sein System basiert auf der Annahme der Schraube zur Ausübung eines Druckes. Seine Apparate haben mit denen Carabellis viel Aehnlichkeit. Gleiche Ziele bringen natürlich auch eine gewisse Gleichheit der Methoden mit sich. Ich verweise auf sein rühmlichst bekanntes Riesenwerk über die Behandlung von Bissdeformitäten. Seine Apparate, die bis zur endgültigen Regulierung eines Falles stets getragen werden mussten, hatten trotz vieler Vorzüge den Nachteil, dass sie schwer zu reinigen waren. Ferner verdienen hier noch besonders erwähnt zu werden: Ch. Tomes, Westcott u. Langstreet, Quinty, Allan, von ausländischen Autoren: Lauer, Magitot, Kuhns und manche andere; aus den achtziger Jahren Coffius, Talbot, Guilford, Matteson, Jackson, Siegfried, die auch meist auf der Anwendung des Pianodrahtes zur Ausübung von Kräften basierten. Ihre Methoden dürften noch genügend bekannt sein, als dass es nötig wäre, sie hier näher zu erörtern. Von den noch nicht erwähnten Werken über Aetiologie und Therapie der Irreguliaritäten sind die bedeutendsten die von Guilford, Talbot und Magitot, sonst gibt es nur wenige.

Wenn auch das Gebiet der Orthodontie durch all die genannten Männer bedeutend erweitert und vertieft wurde, so treten ihre Erfolge doch gegenüber denen der Neuzeit in den Hintergrund. Erst die neueste Zeit mit ihren mathematisch-mechanischen Kenntnissen und der vortrefflich ausgebauten Regulierungstechnik war es vorbehalten, an die Lösung auch der bedeutendsten Aufgaben der zahnärztlichen Orthopädie heranzutreten.

Absichtlich habe ich die Vorzeit etwas ausführlicher geschildert. Um so besser können wir die grossen Fortschritte gebührend würdigen, die die Orthodontie in den letzten Jahrzehnten gemacht hat. Die Hauptursache des rapiden Fortschritts in der letzten Zeit liegt unzweifelhaft in der Auffindung und Vervollkommnung besonders geeigneter Behandlungsmethoden. Die Fortentwicklung der Methoden ist sozusagen das Skelett, das den Fortschritt der gesamten Orthodontie trägt und deshalb ist es nötig, die Entwicklung der Methoden in den Vordergrund zu stellen. In früheren Zeiten gehörte die Behandlung einer Difformität zu den technisch sehr schweren, deshalb häufig auch undenkbaren, was heute nur noch insofern zutrifft, als sie meistens an unruhigen Kindern ausgeführt werden. Heute ist sie, dank der überraschenden Entwicklung der Methoden zu den verhältnismässig leichten zu zählen. Was wir an Hilfsmitteln für die Behandlung der Bissdeformitäten besassen, war lange Zeit wertlos. In den Händen der Erfinder leisteten die empfohlenen Methoden vielfach Ausserordentliches. Die Nachprüfungen nehmen ihnen aber bald den Nimbus des Unfehlbaren. Unsere Resultate besserten sich erst, als eine Reihe verdienstvoller Männer es unternahm, nunmehr auch den Zusammenhang zwischen Ursache und Wirkung aller der vielfachen Methoden zu prüfen und zu erkennen, deren sich Empirie und Praxis mit einer gewissen Routine und manchmal nicht ohne eine Art von Mysticismus für ihr Vorfahren bedient hatten. Hier war nun das Wichtigste zunächst die alten Worte in neue umzuprägen, das Ordnen der Kräfte vorzunehmen, welches das erste Erfordernis einer jeden Wissenschaft ist und nun gewann manche alte Methode in neue Zusammenhänge gebracht, eine grössere Bedeutung.

Unablässige Wiederholungen ähnlicher Operationen liessen bemerken, dass sich Bissdifformitäten nur auf der Basis exacter, wissenschaftlicher Kenntnisse mit Erfolg behandeln liessen. Man befasste sich mit gründlichen physikalischen Studien, um mit Hilfe der Mechanik die Erscheinungen und Gesetze zu erforschen, auf die die othodontischen Methoden sich gründen konnten. Zu gleicher Zeit begann man nach dem inneren Zusammenhang der einzelnen Operationen zu forschen. Man fing an, die erzielten Resultate zu vergleichen und die Misserfolge auf ihre Ursache hin zu untersuchen. So gelang es nach verhältnismässig kurzer Zeit manches Verfahren zu vereinfachen und zu vervollkommnen, dadurch dass man das überflüssige und die Schattenseiten der einzelnen Methoden erkannte, fand man Mittel, den Erfolg in vielen Fällen zu sichern. In dem Grade als die Erfolge sich mehrten, nahm auch das Interesse zu, an den Ursachen der Anomalien. Eine ganze Reihe von Autoren bemühte sich um die Erklärung der Entstehung anomaler Zahnstellungen; andere befassten sich mit mikroskopischen Untersuchungen der in Frage kommenden physiologischen Gewebsveränderungen, um durch die Beobachtung die Gesetzmässigkeit in der Entwicklung des beim Richten der Zähne gebildeten neuen Gewebes nachzuweisen. Mit der Erweiterung und Vertiefung unserer Kenntnisse auf diesem Gebiete wuchsen die Hilfsmittel und mit der wachsenden Befähigung die Schwierigkeiten, die sich der Beseitigung des anormalen Bisses entgegenstellten. Damit steigerten sich auch die Aufgaben, die dem Praktiker gestellt worden. Diese grösseren Aufgaben spornten wieder rückwirkend dazu an, neue Mittel und Wege zu ersinnen, um den gesteigerten Ansprüchen gerecht zu werden. Fragen wir nach dem Ursprung des Fortschrittes unserer Leistungen nach jeder Richtung hin, so ist es klar, dass der innige Zusammenhang der Zahnärztlichen Orthopädie mit allen übrigen Zweigen der Heilkunde ihr in hohem Grade förderlich war. Die Heilkunde verschaffte ihr durch die Erforschung der Gesetze unter abnormen Bedingungen und Begründung der Theorie der Entwicklungshemmungen die gesicherte Grundlage erfolgreicher zahnärztlicher Tätigkeit. Unsere Aufgabe war es, auf Grund der Erkenntnis der Ursachen irgend welcher Abnormitäten umfassende Vorkehrungen zu treffen, die als nächstes Ziel die Korrektur der Difformität verfolgte und zu gleicher Zeit alle in Betracht kommenden ursächlichen Schädlichkeiten bekämpfte. Die moderne zahnärztliche Orthopädie hat mehr noch die Therapie aller Difformitäten der Gesichtsknochen und des Bisses in den Bereich ihrer Tätigkeit gezogen und auch auf dem Gebiete der Behandlung der Prognathien und der rationen der Nase sind die grössten Fortschritte zu verzeichnen. Darauf werde ich später nochmals zurückkommen. Eine ganze Reihe vollendeter Apparate und Systeme entstand durch die Geistesarbeit bedeutender Zahnärzte, mit denen es gelang die denkbar grösste Korrektur aller nur irgend wie heilbaren Difformitäten zu erreichen. So sehen wir hier ein erfreuliches Beispiel praktischer Verwertung der Resultate, die durch wissenschaftliche Erforschung der dem Plane des Organismus widersprechenden Missbildungen und deren Ursache gewonnen sind. Während die wissenschaftliche Betrachtung die einzelnen Fälle von Unregelmässigkeiten beobachtet und verwertet, bietet sich der Regulierungskunst als Objekt das einzelne Individuum. Da

aber das letztere vermöge seiner Organisation den Gesetzen der Missbildungen ihm gleichzeitiger Lebewesen unterworfen ist, die durch erfahrung Experiment und wissenschaftliche Analyse festgestellt worden sind, so kann auch die Difformität des einzelnen Menschen nur auf wissenschaftlicher Grundlage in Ursachen Verlauf und Ausgang nach der Behandlung beurteilt werden. So bietet die medizinische Wissenschaft die sichere Grundlage und die notwendige Voraussetzung für die solide Ausübung unserer Kunst. Für diese Aufgabe reicht allerdings das Vertrautsein mit den Ergebnissen der naturwissenschaftlichen Forschung auf unserm Gebiet allein nicht aus, sondern sie setzt ausserdem beim Zahnarzt die Befähigung voraus, natürliche und künstliche Werkzeuge, die zur Beobachtung dienen, kunstgerecht zu verwenden. Unsere Kunst beruht indessen auch nicht auf der geschickten Anwendung der diagnostischen und therapeutischen Hilfsmittel, die, so unentbehrlich sie sind, doch mehr die mechanische Grundlage des Regulierens darstellen. Das Wesentliche für das letztre ist unzweifelhaft die psychische Leistung des Zahnarztes, die ihn mit Hilfe seiner wissenschaftlichen Kenntnisse und seiner technischen Ausbildung befähigt, den Einzelfall in Diagnose und Behandlungsplan richtig zu beurteilen.

Selbst wo es sich um Fälle handelt, für deren Behandlung es klare und sichere Anzeichen gibt, ist die richtige Anwendung derselben auf die Verhältnisse des Einzelfalles nicht ohne weiteres gegeben. Häufig aber stehen wir vor Aufgaben, die sich streng wissenschaftlich nicht lösen lassen. Ausser den verschiedensten naturwissenschaftlichen und medizinischen Hilfsdisziplinen wurde auch die Kunst in den Bereich der Studien gezogen. Da die Orthodontie auch die Umgestaltung resp. die Veredelung der Gesichtszüge in Betracht zu ziehen hat, so war es erforderlich, das menschliche Angesicht mit allem, was zum Gesichtsausdruck beiträgt, eingehend zu studieren. Denn nur der geübte Beobachter ist fähig ein Gesicht analysieren zu können und so sich von der günstigen Beeinflussung des Gesichtes durch eine orthopädische zahnärztliche Behandlung eine bestimmte Vorstellung zu machen. Hierauf komme ich noch im zweiten Teil meines heutigen Vortrags näher zu sprechen.

Nach diesen unvermeidlichen Abschweifungen in speziellere Gebiete wende ich mich wieder zu der Entwicklung der jüngeren Methoden. In den letzten Decennien behielt die amerikanische Orthopädie die anerkannte Führerschaft. Hier regten die ausgezeichneten Erfolge Professor Angle's auch andere amerikanische Zahnärzte zu regem Schaffen an. Die amerikanische zahnärztliche Heilkunde konnte noch bis in die letzten Jahre als die beste der Welt gelten, wo die Zahnärzte aller Nationen Belehrung fanden. Neben den Amerikanern treten dann immer mehr die Franzosen, Engländer und Deutsche hervor. Sie zeichnen sich aus durch gediegene Kenntnisse, nüchterne, ruhige Kritik und grosse Begabung für die zahnärztliche Technik. In Deutschland vollzieht sich im 19 Jahrhundert der Aufschwung der Zahnheilkunde etwas später als in England und in Frankreich, dann aber auch um so bedeutungsvoller. Gegenwärtig dürfte die deutsche Zahnheilkunde nach jeder Richtung hin, sowohl in wissenschaftlicher als auch in technischer Beziehung mit an der Spitze marschieren. Mit unserem fortschreitenden Wissen und Können hat auch die konservative Richtung

unserer Therapie immer mehr an Bedeutung gewonnen. Die stümperhaften und verstümmelnden Operationen des bleibenden Gebisses werden immer mehr vermieden. Mancher Zahn bleibt erhalten, welcher früher, ohne irgend welche Bedenken, geopfert wurde, um so manchmal den Teufel mit Beelzebub zu vertreiben.

Angle und Case gebührt das Verdienst, die komplizierten früheren Apparate ganz bedeutend verbessert und vereinfacht zu haben und neue wissenschaftliche Systeme ausgebaut zu haben, nach denen heute jeder Zahnarzt arbeiten kann, der etwas Kombinationsgabe und Erfahrung im Regulieren von Zähnen besitzt. Unsere Kenntnisse von Tatsachen auf dem Gebiete der Diagnose und Therapie wurden von Angle und Case enorm erweitert und von dem ersteren zu einem gewissen Abschluss gebracht, indem er mit seinem Hinweis auf die abnorme Bisstellung der ersten Molaren bei den meisten Irregularitäten mit aller phrasenhaften Theorie aufräumte und so einen greifbaren Anhalt für die Entstehungsursachen der Bissdeformitäten gegeben hat. Er schuf so ein frappierend einfaches von ganz wenigen gewissermassen sich logisch von selbst ergebenden Prinzipien ausgehendes System der Bissverschiebung. Die Angle'sche Theorie von den ersten Molaren ist gewissermassen die Blüte der Geistesarbeit dieses genialen Praktikers, der sich durch seine zahlreichen experimentellen Untersuchungen unsterbliche Verdienste um die Zahnheilkunde erworben hat. Vorbildlich ist uns Angle als Theoretiker wie auch als Praktiker. Uns interessiert die Art seines Schaffens. Er ist Meister auf beiden Gebieten. Wenn ihn in letzter Zeit die Priorität in der Anwendung von Gummiringen, die er übrigens auch gar nicht für sich in Anspruch genommen hat, streitig gemacht wurde, so verdanken wir ihm ausser vielem anderem doch die Begründung und Ausgestaltung der Bissverschiebungsmethode.

Auch Case und Baker sollen ihre Verdienste um die Zahnheilkunde nicht geschmälert werden. Ihre weltbekannten Methoden und Erfolge sind von nicht zu unterschätzender Bedeutung für die Entwicklung der zahnärztlichen Orthopädie.

Auf ein ähnliches Prinzip der Verschiebung der Zähne bei der Prognathie des Oberkiefers, wie wir es bei Angle finden, stützten sich auch die von Birgfeld, Hamburg konstruierten und viele Jahre mit günstigem Erfolg angewandten Apparate. Das Verfahren hatte nur den Nachteil, dass man bis zur endgültigen Herstellung der normalen Artikulation mindestens zwei Jahre brauchte. Die Birgfeld'schen Apparate bestehen darin, dass an Ober- und Unterkiefer beiderseitig vermittelst Bänder um die ersten Molaren und Prämolaren schiefe Ebenen angebracht werden. Dadurch wird der Unterkiefer gezwungen um so viel vorzubeissen, als die falsche Artikulation der ersten oberen und unteren Molaren zu einander beträgt und wird dort dauernd festgestellt. Um nun die durch die schiefen Ebenen ausgeübte Kraft zu verstärken, modifizierte ich den Apparat dahin, dass ich mit ihm einmal die Dehnung der Kiefer zu gleicher Zeit mit der Bissverschiebung bewerkstelligen und ausserdem einen ständigen, zweifachen Druck auf Ober- und Unterkiefer ausüben konnte. Zur Dehnung verwandte ich eine am Gaumen entlang gehende Schraube, während ich den Druck dadurch erzielte, dass ich eine Spiralfeder mit weich angelötetem Expansionsbogen in an den Ringen angebrachten Kanälen verankerte. Den Expansionsbogen, der das Bestreben hatte nach vorne auszu-

weichen, band ich mit Seide oder Aluminiumbronze-Draht an die Zähne fest. Die Vorzüge der Angle'schen Methode gegenüber dieser Modifikationsmethode und gegenüber allen anderen, besteht in der sicheren Fixation der nach auswärts gebrachten Zähne in der fast vollkommenen Entlastung der Zunge, in der Einfachheit der Technik und vor allem in der Möglichkeit, die Artikulationen verhältnismässig schnell und ohne viel Quälerei des Patienten richtig zu stellen.

Was nun die Diagnose anlangt, so haben wir durch die Angle'sche Theorie von der Stellung der ersten Molaren zu ihren Antagonisten einen wertvollen Fingerzeig für die richtige Diagnostisierung einer Unregelmäissigkeit und darauf ist doch neben der Operationsmethode der Hauptakzent zu legen. Der Schwerpunkt der Angle'schen Methode liegt in der Sicherheit der Diagnose und der Richtigstellung der ersten Molaren als dem Ausgangspunkt der falschen Artikulation bei den meisten Irregularitäten. Die Versehiebung der Molaren und daran anschliessend der übrigen Zähne, gelingt in ausgezeichneter Weise durch die sweifache Wirkung der angewandten Gummiringe. Die Resultate, die ich bisher erzielte, sind die denkbar güustigsten. Die betreffenden Apparate werden von dem Patienten um so lieber getragen, als sie nur im Anfang stören und sehr bald ein in die Augen springender Erfolg zu bemerken ist.

Ohne auf die nähere Beschreibung der Angle'schen Methode die als bekannt vorausgesetzt werden darf, einzugehen, will ich nur noch kurz auf die besonders von Bride, Dresden vertretene Ansicht zu sprechen kommen, dass die Richtigstellung der Artikulationen bei dem Angle'schen Verfahren nur eine Folge von Veränderungen im Kiefergelenk sei. Ich selbst habe schon im vergangenen Jahr in Frankfurt über diesen Punkt referiert und glaubte damals auf Grund meiner Beobachtungen Bride's Ansicht zustimmen zu können. Wahrscheinlich, so führte ich damals aus, trete durch den permanent wirkenden Gummiring der Gelenkkopf auf das Tuberkulum articulare und dort werde er festgehalten, nachdem durch Neubildung des Bindegewebes die Chavitas glenoidalis . . . .* sei. Wir hätten hier mit der Erscheinung der funktionellen Anpassung zu rechnen und es sei sehr wohl denkbar, dass ähnlich wie bei der unblutigen Operation kongenitaler Hüftgelenkluxationen nach Lorenz ein neues Gelenk gebildet werde. Die Verhältnisse liegen im Kiefergelenk tatsächlich ungleich günstiger als im Hüftgelenk. Denn bei der Vorwärtsbewegung des Unterkiefers bilden bekanntlich der Zwischenknorpel für den Gelenkkopf eine Pfanne. Der Zwischenknorpel repräsentiert somit für den Kondylus eine transportable Pfanne, in dem die mannigfaltigen Bewegungen des Unterkiefers durch seine Vermittlung ausgeführt werden. Es steht nun auch heute noch für mich fest, dass Veränderungen im Kiefergeleuk stattfinden, wenn auch unbedeutender Art; dass aber die richtige Artikulation mehr eine Folge der vor—und rücktwärtigen Verschiebungen der Zähne ist.

Es erübrigt noch an deutschen Autoren Heidenhaus', Walkhoff's und Sternfeld's zu gedenken, von denen wir mehrere Apparate für die Behandlung der Prognathie besitzen. Als besonders zweckmässig ist aber Heidenhaus' Dehnungsapparat für den Oberkiefer anzusehen.

Die Reform der modernen Orthodontie wurde nur dadurch ermöglicht, dass sich

* [*Sic.*—Ed. Committee.]

die wissenschaftlichen Forschungen in der Orthodontie eng anlehnten an naturwissenschaftliche Ergebnisse in der Physiologie, in der Physik und in der allgemeinen experimentellen Pathologie. Und wenn auch vieles noch zu schaffen und zu leisten ist, so lässt sich heute doch schon mit hinreichender Sicherheit zeigen, dass die Vorbedingungen erfüllt sind, die die Behandlung auch der schwierigeren Difformitäten des Bisses einem jeden Zahnarzt ermöglichen. Es bedarf hier wohl keines Beweises, welchen Segen wir durch die Beseitigung von Bissdeformitäten stiften, die ausser einer bedeutenden Gesichtsentstellung auch noch durch erschwertes und ungenügendes Kauen zu Ernährungsstörungen Veranlassung geben können den Patient sprachlich behindern und nicht selten alle möglichen Erkrankungen im Nasenrachenraum und der Luftwege im Gefolge haben.

Ueberblicken wir nochmals die soeben in fragmentarischer Kürze zusammengestellten Tatsachen und Gesichtspunkte, so lässt sich nicht verkennen, dass ein bedeutsamer Fortschritt angebahnt ist und dass weitere wichtige Aufschlüsse erwartet werden dürfen. Von besonderem Interesse dürfte das Studium der Nasenerkrankungen in Gemeinschaft mit Bissdeformitäten werden, in Rücksicht auf die durch die korrektive Behandlung bewirkte günstige Veränderung des Knochengerüstes der Nase.

Wenn wir heute durch unsere Erfahrungen nach dieser Richtung hin berechtigt sind, den Satz aufzustellen, dass nahezu jede Prognathie pathologische Veränderungen in der Nase zur Folge hat (und diese Wechselbeziehungen sind ohne Schwierigkeit nachzuweisen) so sind wir auch verpflichtet, den Vorbildungen des knorpeligen und knöchernen Nasengerüstes mehr als bisher unsere Aufmerksamkeit zu widmen. Alle Verengerungen, die durch ein Zunahetreten der äusseren Nasenwände entstanden sind, werden heute von den Nasenärzten auf operativem Wege, d.h. durch Wegnahme eines Teils oder der ganzen unteren Muschel beseitigt. Welche unnötign Nasenoperationen wir durch eine zweckmässige Behandlung von unregelmässigen Kiefern verhindern können, beweisen unsere Resultate, die wir durch eine entsprechende Dehnung des Oberkiefers und der Nase erzielen. Doch da ich in einem, durch Projektionsbilder illustierten Vortrage noch auf alles dies zu sprechen komme, so will ich nunmehr zu dem letzten Teile meiner Besprechung, der Aetiologie der Irregularitäten übergehen.

Wie steht es nun mit unsern gegenwärtigen Vorstellungen über die Entstehungsursachen von Difformitäten der Zähne und der Gesichtsknochen? Am besten bekannt, wenn auch nicht in dem Masse klar wie man oft glaubt, sind die vererbten Abnormitäten. Ueber viele diesbezügliche Fragen gibt uns die Anthropologische Wissenschaft ausreichende Erklärung. Ihr haben wir in den letzten Jahren so manchen bedeutungsvollen Aufschluss zu verdanken über die Menschenrassen und ihre Varitäten in Bezug auf die charakteristischen Eigenschaften und progressive Vererbung, d.i. die Vererbung erworbener Eigenschaften. Für den genauer Zusehenden bestehen aber auch hier in einer ganzen Reihe von Fragen noch zahlreiche bisher unerklärte Variationen. Auf sie zu achten, ist auch aus praktischen Gründen höchst wünschenswert, denn es kann wohl durch eine sorgfältig unterscheidende Auswahl von vererbten Deformitäten noch mancher therapeutische Erfolg erzielt werden.

Von grosser Wichtigkeit wäre es ferner, die einzelnen Arten von Irregularitäten exact zu erklären. Wenn über sie auch eine grosse Reihe von Erfahrungen vorliegt, so fehlt doch das Gesamtbild und daher muss die Erklärung einzelner Arten von unregelmässiger Zahnstellung als eine recht unvollkommene bezeichnet werden, ja teilweise fehlt sie noch ganz. Die Schwierigkeiten einer Klassifikation und Nomenklatur der Irregularitäten auf Grund der vergleichenden Zahnkunde sind noch immer bedeutend. Der von Walkhoff in dieser Richtung gemachte Versuch kann wohl als Grundlage dienen. An dem genetischen Prinzip als Grundlage einer wissenschaftlichen Einteilung der Irregularitäten ist . . . .

Recht dunkel liegt für uns auch die Frage, ob stehengebliebene Milchzähne als Ursache oder als Folge der unregelmässigen Stellung der . . . . Zähne anzusehen sind. Dass nicht oder nur zum Teil resorbirte Milchzähne wie auch Reste von Milchzähnwurzeln die Richtung der durchbrechenden bleibenden Zähne ungünstig zu beeinflussen vermögen, haben wir alle wohl schon in der Praxis gesehen. Damit ist aber noch lange nicht die Frage aus der Welt geschafft, ob der bleibende Zahn infolge von Vorlagerung unregelmässig durchbricht und infolge der Vorlagerung naturgemäss auch keine Resorbtion des Vorgängers im Milchgebiss erfolgen kann oder ob der Milchzahn aus irgend einem anderen Grund nicht resorbiert wurde und so die Ursache zu unregelmässigem Durchbruch wurde. Meiner Beobachtung nach trägt weder die Vorlagerung noch der resorbierte Milchzahn die Schuld an dem unregelmässigen Durchbruch, sondern einzig und allein der zu enge Kiefer. Zu der Zeit, wo die beiden mittleren unteren Schneidezähne durchbrechen, sind die sterblichen Milchzähne noch nicht oder nur zum Teil resorbiert, die meist viel breitereren Schneidezähne finden zum Durchbruch keinen Platz vor und müssen nun einfach zur Seite ausweichen, wodurch denn auch wieder die weitere Resorbtion des Milchzahns unterbleibt. Ich für meinen Teil habe wenigstens nie beobachtet, dass Milchzähne in einem für die bleibenden Zähne genügend grossen Kiefer nicht resorbiert worden wären.

Auch in der Wissenschaft herrscht die Mode, aber sie wird hier nicht erzeugt durch mehr oder weniger banale Einfälle irgend welcher mittelmässiger Köpfe, sondern meist liegt die Sache so, dass der Einfluss grosser Entdeckungen für längere Zeit die Richtung der Arbeit in eine ganz bestimmte Bahn zwängt und dann kommt es sehr oft zu einer gewissen Vernachlässigung oder zu einem weniger ergibigen Ausbau anderer Gebiete.

In der Aetiologie der Irregularitäten stehen wir mitten in einer solchen Entwicklungsperiode. Denn es wäre falsch zu verschweigen, dass unter dem Eindruck der neuen Fortschritte in der Therapie der Difformitäten in der Freude dieser interessanten Tätifkeit die Kenntnis der Aetiologie der Irregularitäten einen einseitigen Verlauf nahm. Keineswegs wurde mit dem gleichen Eifer den Ursachen der Irregularitäten nachgeforscht. Nicht als ob die Berücksichtigung aetiologischer Verhältnisse absichtlich vernachlässigt worden wäre, trotzdem aber gehört der Gegenstand noch zu den dunkelsten Punkten, die in der Lehre von den Missbildungen vorhanden sind. Das kommt wohl daher, dass eine wirkliche Vertrautheit mit den nach aetiologischer Art zu behandelnden Fragen einen Aufwand an Zeit und Mühe erfor-

dert, wie ihn eine körperlich und seelisch aufreibende praktisch zahnärztliche Tätigkeit vielfach nicht gestattet.

Die Frage nach der Entstehung von unregelmässigen Stellungen der Zähne ist wichtig für die Prophylaxis und Therapie derselben. Nur das Zusammentragen möglichst vieler Einzelbeobachtungen und Erfahrungen kann hier zu einem endgültigen Urteil führen. Die Ursachen der Zahnunregelmässigkeiten sind bis auf den heutigen Tag bei uns ein verhältnismässig wenig besprochenes Thema; wir sind zwar im Besitze einer grösseren Anzahl von Theorieen, haben jedoch in jenen Fragen kaum klärende Gesichtspunkte als Ergebnis des letzten Jahrzehnts zu verzeichnen. Am eingehendsten mit der Frage der Aetiologie hat sich von deutschen Zahnärzten Professor Walkhoff beschäftigt. Auch Sternfelds Arbeiten verdienen hier besonders erwähnt zu werden. Von ausländischen Autoren sind besonders zu nennen: Cartwight, Mummery, Talbot, Tomes, Carabelli, Kingsley und andere.

Die Zahn- und Kieferdeformitäten sind nun entweder angeboren oder erst nach der Geburt im Verlaufe des weiteren Lebens erworben. Die Ursachen im ersten Falle liegen entweder in Entwicklungsfehlern und Entwicklungshemmungen der Kieferknochen resp. der Zähne und sind dann zum Teil vererbt oder sie liegen in der Vererbung von Eigentümlichkeiten, die bei beiden Eltern getrennt vorkommen und nun bei dem Kinde vereint, eine Unregelmässigkeit bedingen. Hierher gehört z.B. die Vererbung der Kieferanlage indem entweder diese im Verhältnis zu den Zähnen zu klein oder die letzteren im Verhältnis zum Kiefer zu gross sind. Ein Kind kann einen kleinen Oberkiefer von der Mutter, einen grossen Unterkiefer vom Vater erben oder kleine Kiefer von der Mutter und grosse Zähne vom Vater und umgekehrt. Nach Walkhoff zeigen besonders die Mischehen verschiedener Rassen viele solche Unregelmässigkeiten indirekter Vererbung.

Die vererbte Anlage zu bestimmten Deformitäten wird natürlich am stärksten sein, wenn beide Eltern dieselbe besassen., während Aussicht auf Abschwächung besteht, wenn sie nicht bei beiden Eltern vorhanden war. Besonders auffällig wird die Erblichkeit neu erstandener Eigentümlichkeiten, wenn dieselben aus dem Kreis der regelmässigen Bildung heraustreten, wie bei den Missbildungen. Von den vererbten Missbildungen müssen nun die angeborenen unterschieden werden. Unter angeborenen (congenitalen) Deformitäten verstehen wir solche, die den Kindern anhaften, aber den Eltern durchaus fehlten. Bei den neuauftretenden erblichen Eigenschaften beobachtet man die merkwürdige Erscheinung, dass sie von den Nachkommen nicht mit auf die Welt gebracht werden, sondern dass sie sich erst in demselben Alter entwickeln, in welchem sie bei den Vorfahren zuerst auftraten. Auf der Erblichkeit neu auftretender Eigenschaften beruht bekanntlich die Veränderlichkeit der Arten in bestimmten Richtungen und die Möglichkeit der Züchtung durch Auswahl erwünschter Rassen unter den Haustieren. Hierbei kommt noch ein begünstigendes Moment in Betracht, dessen gleichmässige Wirkungsweise man progressive Erblichkeit nennt. Häufig scheint nämlich nicht nur ein bestimmter Grad der Abänderung, sondern eine Tendenz zur weiteren Abänderung in derselben Richtung vererbt zu werden. Als Beweis für die Vererbung erworbener Eigentümlichkeiten ist von vielen Seiten schon die Tatsache geltend gemacht worden, dass

Nichtgebrauch eine Reduktion der betreffenden Organe zur Folge hat. Funktion befördert die Ausbildung. Wegfall oder Einschränkung der Funktion bedingt die Reduktion eines Organs am Individuum. Allmähliche Reduktion im Laufe philogenetischer Entwicklungen ist nur durch Verbindung dieses Vorganges mit erblicher Uebertragung der erworbenen Eigentümlichkeiten zu verstehen. Nach Darwin zeigen die Mahlzähne bei den civilisierten Rassen eine Neigung zur Verkümmerung. Auf dem Boden der Descendenztheorie stehend, müssen wir versuchen, von Fall zu Fall die einzelnen Erscheinungen, in welchen das Problem der Entwicklung uns entgegentritt, in exacter Weise zu prüfen, bevor wir ein abschliessendes Urteil über das Wesen der entwicklungsgeschichtlichen Vorgänge abgeben können. Wir wissen einmal, dass Civilisation und Rassenmischung bedeutenden Einfluss auf die Entwicklung der Kiefer hat. Reine Rassen weisen reinen gleichförmigen Typus auf, während derselbe bei einer Kreuzung der verschiedensten Rassen umsomehr wechselt, je mehr die Mischung zunimmt. Nach Mitteilungen von Forschungsreisenden gehören Unregelmässigkeiten bei den meisten wilden Völkerschaften, die sich mit anderen Stämmen nicht vermischt haben, zu den grössten Seltenheiten. Hier ist die Annahme berechtigt, dass solche Abnormitäten durch eine Art Züchtung entstehen. Ich bin nun gar nicht von der Allmacht des Selectionsprinzipes überzeugt, stehe im Gegenteil auf dem Standpunkte, dass es überhaupt nicht möglich ist, alle Vorgänge der Artenentstehung auf dieselbe Weise zu erklären und dass sehr wohl neben dem Selectionsprinzip noch andere in der organischen Welt umgestaltend wirken können. Ich kann mich aber auch nicht mit der Ansicht Kingsley's und anderer Autoren befreunden, die hier einfach eine Zuchtwahl bestreiten. Nach Kingsley sind solche Abnormitäten nicht das Resultat einer höheren Civilisation und Verfeinerung, sondern sie sind nur als zufällige Begleiterscheinungen im Gefolge der Civilisation aufzufassen.

A *résumé* in English of the foregoing paper here follows:

Development of Diagnostic and Therapeutic Methods, and the Importance of Etiology in Relation to Orthodontia.

Within the limits of a brief paper it is not possible to do justice to the important ramifications of the science of orthodontia.

With the intention of calling forth expression of opinion in a matter of great significance, in my paper I have briefly touched upon the subject of progress in regulating devices viewed from the mechanical standpoint.

How grateful must mankind ever be to such men as Hunter and Fox in England, Schange and Lachaise in France, Dwinelle, Kingsley, and Farrar in America, and Linderer and Carabelli in Germany for their contributions to orthodontia and invention and improvement of mechanical devices used in connection with that science. The appliances of Schange, Carabelli, Kingsley, and Farrar in particular are noted.

The limited scope of my paper does not permit me to allude to a large number of investigators who have contributed to the development of orthodontia; the framework of the science was erected by the men whom I have mentioned and to their conceptions I give the greater prominence.

Impulse came mainly from America, where, thanks to the application of worthy devotees, supremacy is still retained; these efforts are seconded by investigators in Europe whose diligence has raised them to an equal plane.

The work of Angle and Case based as it is upon true scientific principles stands prominently in the foreground. The systems invented by them applied to the correction of irregularities leave nothing to be desired and form a fruitful source of practical methods now drawn upon by the dental profession. In my paper I discuss many methods for correcting irregularities, and I give especial attention to the appliances of Angle and Bergfeld, both constructed on the same principle. The method of Bergfeld has been modified by the essayist. The appliances of Angle possess undoubted advantages over those of Bergfeld, particularly as regards rapid correction of articulation.

Angle's predominance is made evident by his system of accurate and unfailing diagnosis and correct placing of the first molars, which, after all, is the essential point in the correction of faulty articulation in most irregularities. The moving of the molars is made particularly successful by means of the double result of the intermaxillary anchorage. Angle's classification affords a ready means for diagnosis and constitutes an important addition to orthodontia.

By research the diagnosis and therapeutics of orthodontia have been directed into true and perfectly definite channels. When we take into consideration the correction of facial deformities, the treatment of diseases of the nose and respiratory organs, the elimination of difficult mastication brought about by the use of orthodontic appliances, then must we recognize the great importance of these appliances.

The etiology of maxillary deformities is still in its infancy. Its relation to prophylaxis and therapeutics strongly emphasizes the need for further development. The existing diversity of opinion among specialists in the treatment of maxillary deformities is by no means desirable, yet must eventually lead to successful unanimity.

It is important to properly define each case of maxillary deformity and to have a definite and accurate nomenclature. The results of Walkhoff's work might be taken as a basis on which to build a system of nomenclature. A scientific division of irregularities in which they are classed according to generic principles must be adopted and adhered to.

Irregularities are either hereditary or acquired, though their causes may be partly due to faulty development and partly to heredity—as often happens in the intermixture of races. Progressive heredity is often seen. The degree of culture as well as the intermixture of races has an influence upon the formation of the jaws, as is exemplified by Kingsley.

Another paper was also presented by Hofzahnarzt Wilhelm Pfaff, on the "Value of Art in Orthodontia." The paper in German, together with a *résumé* in English, here follows:

Ueber den Wert künstlerischer Studien für die Zahnärztlich-orthopädische Praxis.

Von Hofzahnarzt WILHELM PFAFF, Dresden, Germany.

Wenden wir uns der künstlerischen Aufgabe zu, die bei jeder bedeutenderen Irregularität vorliegt, Leider gibt es heute noch so manchen Zahnarzt, der die Behandlung von unregelmässiger Zahn- und Kieferstellung zu einer rein mechanischen und handwerksmässigen Tätigkeit stempeln möchte. Dass hierzu aber mehr gehört, als manuelle Geschicklichkeit, wird der erfahren haben, der sich je mit diesem Zweige der Zahnheilkunde beschäftigt hat.

Jede Regulierung dient zunächst einem bestimmten Zweck und diesem Zweck entsprechend werden ihre Mittel ausgebildet und entwickelt. Wie überall wachsen auch hier die Kräfte über die blosse Befriedigung des Notwendigen hinaus. Die Betätigung allein schon erfüllt uns mit Freude und das heranreifende Können findet neue zu lösende Aufgaben. Wir werden sehen, wie weit gerade die Grundbedingungen der Regulierungstätigkeit künstlerischen Regungen entgegenkommen. Ein jeder weiss, wie sehr wir gewöhnt sind, einen Menschen allein nach dem Gesicht zu beurteilen, so dass eine schöne Bildung desselben meist alle Fehler des Körpers vergessen lässt; ein hässliches Gesicht aber trotz aller Vorzüge des übrigen Körpers ein Verdammungsurteil in sich schliesst. Sind wir nun berechtigt den Standpunkt einzunehmen, dass wir durch unsere Behandlungen den Patienten nicht nur bessere Bissverhältnisse verschaffen, sondern das Aussehen auch ganz bedeutend verbessern, wenn wir vom Anfang bis zum Ende der Behandlung exact vorgegangen sind, so sind wir auch verpflichtet, das menschliche Gesicht in den Bereich unserer Studien zu ziehen. Gleich dem Künstler haben wir ein Idealprofil nötig, das uns bei unseren Gesichtsverbesserungen als Vorbild zu dienen hat. Der Schönheitsbegriff eines Idealprofils entwickelt sich erst aus einer durch tägliche Uebung ermöglichten Kenntnis des Kopfes. Jeder von Ihnen wird mit mir darin übereinstimmen, dass das Gesicht als der Teil, den man täglich vom Körper unverhüllt zu sehen bekommt, von den meisten Menschen mit wenig kritischem Blick betrachtet wird, weil ihr Blick ungeübt ist. Man vergegenwärtige sich z.B. die Gesichtszüge, die Augen, die Stirn etc. solcher Personen, die man fortwährend vor Augen hat und man wird finden, dass man in der Regel nicht imstande ist, darüber bestimmte Angaben zu machen. Danach versteht es sich von selbst, dass alles, was zum Gesichtsausdruck beiträgt, eingehend zu studieren ist. Denn nur der geübte Beobachter ist fähig, ein Gesicht analysieren zu können und so sich von der günstigen Beeinflussung desselben durch eine Behandlung eine bestimmte Vorstellung zu machen.

Wir haben uns hier nun zunächst mit der Art und Weise zu befassen, wie man sich vom zahnärztlichen Standpunkte aus den richtigen Eindruck von der Gesichts-

form verschafft. Für uns genügt die Betrachtung im Profil und en face. Man stelle den Patienten dem Fenster gegenüber, damit das volle Licht gleichmässig auf das Gesicht fällt und stelle sich in einigem Abstand mit dem Rücken nach dem Fenster, dem zu beurteilenden Patienten genau gegenüber. Dies ist wichtig, da bei schräger Beleuchtung es kaum möglich ist, die rechte mit der linken Gesichtschälfte vergleichen zu können. Nun orientiere man sich zunächst über das Verhältnis der einzelnen Gesichtsteile zu einander und zum ganzen Gesicht. Hierauf nehme man sich vom Gesicht einen Gipsabdruck. Diesen nimmt man am besten auf folgende Weise: Zuerst bestreicht man das Gesicht überall gut mit Vaseline, überklebt starke Augenbrauen resp. Schnurrbart mit Watte, lässt dem Patienten die Augen schliessen. Nachdem man sich vergewissert hat, ob Nasenatmung möglich ist, trägt der Assistent schnell dünn angerührten Gips auf das ganze Gesicht auf, während man selbst die Verstopfung der Nasenlöcher mit Gips zu verhüten hat. Nach der Erhärtung entfernt man vorsichtig den Abdruck und behandelt ihn hierauf wie wir dies bei allen unseren Gipsabdrücken gewöhnt sind. Um uns darüber klar zu werden, welche Anforderungen wir anatomisch an eine schöne Gesichtsbildung zu stellen haben, müssen wir zuerst auf die embryonale Entwicklung derselben zurückgreifen.

Bei menschlichen Embryonen ist im Anfang nur der Unterkiefer vorhanden. Das Obergesicht entwickelt sich in der Folge von zwei Seiten aus. Erstens treibt der Unterkiefer an seiner Wurzel einen wulstartigen Fortsatz, welcher sich unter dem Auge nach der Mittellinie hinschiebt, den Oberkieferfortsatz, dazu bestimmt, die seitlichen Gesichtsteile zu bilden. Von Knochen entstehen auf seiner Grundlage die Oberkiefer mit den Jochbeinen, die Gaumenbeine und die Flügelbeine. Zweitens erhebt sich von der Unterfläche des Vorderhirns aus eine Leiste, welche durch die Riechgrube unterbrochen und in zwei Teile geteilt wird. Der mittlere Teil ist der mittlere Nasenfortsatz. Zu beiden Seiten der Riechgruben stehen die seitlichen Nasenfortsätze. Der erstere entwickelt sich zu den Gebilden der median stehenden Nasenscheidewand und dem mit ihr in unmittelbarstem Zusammenhang stehenden Zwischenkiefer. Der laterale Nasenfortsatz birgt die Keime für die Siebbeinlabyrinte, die Nasenbeine, Tränenbeine und die seitlichen Nasenknorpel in sich. Vgl. J. Henle pag. 39 über Schädelentwicklung. Von der gleichmässigen Entwicklung dieser Fortsätze hängt wesentlich die regelmässige Form des Gesichtes ab. Die Oberkieferfortsätze spielen dabei eine Hauptrolle. Unvollständige Verwachsungen der Fortsatzbildungen sind es, die auf verschiedene Art kombiniert als Missbildung vorkommen (Gaumen-Kiefer- und Lippenspalte) Vgl. Gegenbauer pag. 45. Jeder der angegebenen Fortsätze enthält in der Anlage die Haut, die Muskeln, die Blutgefässe, die Nerven und die Knochen des zukünftigen Gesichts und an den letzteren ganz besonders haben wir einen Masstab zur Beurteilung des entwickelten Gesichtes.

Vergleichen wir mit der Embryonalanlage den Schädel eines Neugeborenen, so sehen wir, dass die den drei Nasenfortsätzen angehörenden Knochen die Nasenbeine und der Zwischenkiefer an Wachstum durch die Knochen des Oberkiefers und Jochbogens weit überholt sind.

Die Oberkieferknochen bilden den Mittelpunkt, um den sich die übrigen

Knochen des Gesichts anordnen. Sie bilden zusammen mit dem Zwischenkiefer die obere Begrenzung des Mundes und die untere der Nase. Weiter nach oben begrenzen sie einen Teil der Augenhöhle und scheiden diese von der Nase. Augen, Mund und Nase, die wichtigsten Teile des Gesichts, sind dadurch von der Entwicklung des Oberkiefers abhängig. Vergleichen wir nun den Schädel des Neugeborenen mit dem eines Erwachsenen, so ist der Einfluss des Wachstums des Oberkiefers sofort gekennzeichnet. Die oberen Ausläufer des Oberkiefers beeinflussen Nase und Augen, die mittleren die Backenknochen und Nase; während von der Entwicklung der unteren Teile die Bildung der Oberlippe abhängt. Unter all den bei der Gesichtsbildung in Betracht kommenden Gesichtsknochen nimmt der Oberkiefer somit die erste Stelle ein und da interessiert uns am meisten die Frage, welches die beste Bildung des Oberkiefers ist. Am wenigssten schön werden wir stets einen prognathen Oberkiefer finden, da er dem Gesicht eine schnauzenförmige Gestalt gibt und mit einer Verstärkung der oberen Mundpartie, eine Verkürzung und Verbreiterung der Nasengegend Hand in Hand geht. Die Nase wird hierdurch in die Höhe gebogen und breiter, wodurch der Eingang der Nasenlöcher sichtbar wird. Meist ist noch mit einer Prognathie des Oberkiefers eine zurückgebliebene Entwicklung des Unterkiefers verbunden, wodurch das Gesamtausschen des betreffenden Gesichts noch ungünstiger beeinflusst wird. Stehen die unteren Partieen des Oberkiefers dagegen senkrechter und bleiben sie schmal, so tritt die Mundpartie mehr zurück, die Nase wird nach unten zu schmäler und länger. Aus allen solchen Momenten resultieren natürlich zahlreiche Verschiedenheiten der Gesichtsbildung. Da nun ein breiter, kurzer und vorstehender Oberkiefer das Merkmal des Neger- resp. des Affentypus darstellt, so ist die Gesichtsbildung um so schöner ausgeprägt, je schmaler, länger und senkrechter der Oberkiefer sich entwickelt hat. Das Resultat einer derartigen Bildung ist eine schmale und gestreckte Nase, eine gleichmässige, mehr senkrechte Abflachung der seitlichen Nasenpartieen nach der Oberlippe zu, senkrechter Stand der Zähne und wenig vortretende Backenknochen. Aus alledem ergibt sich, dass durch die knöchernen Unterlagen die Hauptformen des Gesichts bestimmt sind, wodurch ein grosser Spielraum für unsere Gesichtsverbesserung gegeben ist.

Weitere Fragen, wie den Ausdruck des Gesichts etc. hier näher zu erörtern, hiesse die Grenzen dieses Vortrags weit überschreiten. Wollen wir nun möglichst gute Resultate erzielen, so sind wir besonders mit Rücksicht auf andere Gebiete, unserer Tätigkeit, wo wir auch eines gewissen künstlerischen Blickes bedürfen, zur Aufstellung des Satzes berechtigt, dass jeder Zahnarzt ein gut Teil vom Künstler haben muss. Dabei haben wir uns aber vorzusehen, dass der Künstler den Zahnarzt nicht übermanne. Dies möchte genügen, um den Wert Künstlerischer Studien für uns zu rechtfertigen. Wenn Sie bedenken, dass die Orthodontie so zu sagen noch in ihren Kinderschuhen steckt, so haben wir allen Grund mit unseren bisherigen Erfolgen nach dieser Richtung hin zufrieden zu sein, Doch rasten heisst rosten. Drum lassen Sie uns weiter arbeiten und vereint dazu beitragen, dass das Regulierungsgebiet Allgemeingut aller Zahnärzte wird, vielleicht dass es uns denn auch mehr als bisher gelingt, das Entstehen vieler Irregularitäten zu verhüten.

A brief summary in English of the foregoing paper here follows:

On the Value of Art in the Practice of Orthodontia.

In order that orthodontia should fill its purpose it must be practiced upon an artistic basis. As the duty of the orthodontist is to beautify the human face, he must therefore possess an accurate idea of beauty and a critical sense of observation. He must make a study of the face and judge whether the treatment of the malocclusion will improve the patient's profile. The comparison of the cranium of the embryo and the adult reveals the interesting fact that the maxilla is the middle point against which the other facial bones converge. Together with the intermaxillary it forms the upper boundary of the mouth and the lower of the nose. The shape of the mouth and nose, the two most important features of the face, depend largely on the development of the maxilla.

The author studies the forms of maxilla which lead to the formation of faces with harmonizing features. In the case of a prominent maxilla the face assumes an unattractive appearance owing to a disproportion in the size of the upper and lower parts of the face. A pronounced development of the maxilla is often concomitant with a retarded development of the mandible. If the lower part of the maxilla is perpendicular and narrow the mouth recedes and the nose is small and broad at its base.

The author studies in detail those changes in the bones of the face due to excessive or insufficient development of the maxilla and mandible, and emphasizes the fact that the orthodontist, in order to be successful, must have a thorough conception of art as related to the correction of facial deformities brought about by irregularities of the teeth.

A paper entitled "On the Correction of Deformities Resulting from Fractures of the Nose," by Dr. Francisque Martin of Lyons, France, was read by title. The paper is here appended:

On the Correction of Deformities the Result of Nasal Fractures: Method of Dr. Claude Martin of Lyons.

By Dr. FRANCISQUE MARTIN, Lyons, France.

The paper which I have the honor to submit to you, dealing with the correction of nasal deformities following fracture, would seem at first sight to have but little relationship with orthodontia.

From the strictly scientific and technical standpoint the relationship is indeed small, but as regards the making of the apparatus there is great similarity. The question falls entirely within the dentist's sphere of work, which not only requires ingenuity but also the exact adjustment of delicate apparatus. In the case in question careful and judicious application of such apparatus will improve the patient's appearance in the same degree as orthodontia will in straightening and building out the teeth.

The treatment of nasal fractures, further, has an indirect relationship with orthodontia, for the setting not only has an esthetic but also a functional importance. Thus a badly set fracture of the nasal bones will always leave behind it a certain degree of obstruction. We are well acquainted with the fatal sequences such obstruction of the nasal fossæ has on the mouth, and especially on the teeth. On the one hand the patient breathes through his mouth, which remains constantly open; and on the other, the teeth of the lower and upper jaws meet only when masticating; they consequently soon alter their position, and finally constitute a most imperfect articulation.

Such are the reasons that have induced me to present to you the treatment of nasal fractures, which though at first seems foreign to orthodontia, yet is part and parcel of our profession, the mechanical skill essential in making the apparatus being identical in its principles to the requirements of our art. Indeed, the principles of mechanical dentistry should be applied in any region of the head whenever there is occasion; for, as Claude Martin said at the Madrid Congress of 1903, "Le dentiste est l'auxiliaire précieux du chirurgien dans toutes les restaurations de la face."

At the International Dental Congress of 1900 Claude Martin exhibited two instruments used to correct all deformities of the nose. Since then we have often had occasion to apply his method, and today I bring before you the instruments we have used, together with a description of their best means of application.

At the congress of 1900 my father held the opinion that in order to satisfactorily correct nasal deformities it was necessary in the first place to raise the fragments from inside and subsequently to keep them in their proper position by the help of instruments exerting a certain pressure from below upward—the apparatus being left in its place the necessary time for consolidation.

The instruments which I submit to you fulfill these two conditions. They have given us perfect results.

THE INSTRUMENTS.

There are two instruments. One is a lever forceps of a special design, used to raise the fragments; the other is an apparatus designed to maintain the raised fragments in their proper position, until the fracture is completely set.

(1) The *lever forceps* consists of two branches (Fig. 1). One branch acting

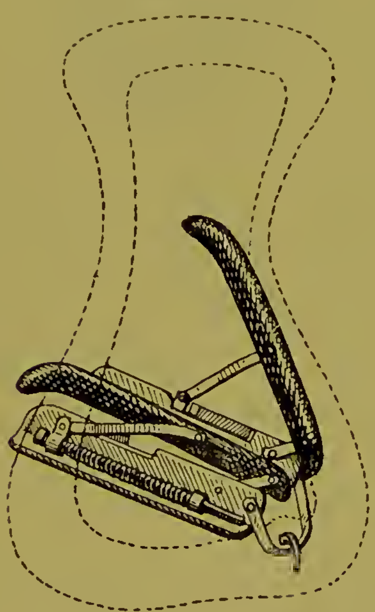
Fig. 1.

as the point of leverage is applied to the floor of the nasal fossæ. Near its point of articulation there is a kind of buffer which prevents the instrument being introduced too far. The other or movable branch is made up of two levers acting

on each other by means of a groove. One lever, corresponding to the handle of the forceps, is straight; the other, corresponding to the bit, is bent. The important result obtained by this arrangement is that pressure tending to bring the handles together opens out the bits. The end of this curved branch is applied to the posterior part of the nasal bones, and raises them in proportion to the pressure exerted on the handles of the forceps.

(2) *Apparatus of retention.* This apparatus, consisting of two horizontal hard-rubber blades, is introduced into and placed on the floor of the fossæ on each side of the nasal septum. At the anterior extremity of these blades there are two similar blades acting on the first pair—by means of a screw—as one branch of a compass acts on the other.

Fig. 2.



(Fig. 2.) The superior and anterior borders of these two blades are applied to the posterior surface of the nose.

Notwithstanding the services rendered by this apparatus, we have found that it does not exert equal and uniform pressure on the total length of the posterior surface of the nose, this defect being due to the type of articulation between the two sets of blades, which diminishes the upward pressure at the near end. In order to remove this defect (which at times may be very inconvenient) and at

Fig. 3.

the same time to give the instrument greater elasticity and suppleness, I have made the two pairs of blades independent of each other, and arranged it so that by a system of levers the blades can only be raised or lowered by the screw.

The levers possess at their upper ends, blades which exert a very uniform pressure, fitting exactly to the whole posterior surface of the nose. They thus maintain the reduction in every point. The pressure exerted by the blades inside the nose can of course be graduated exactly by the special screw.

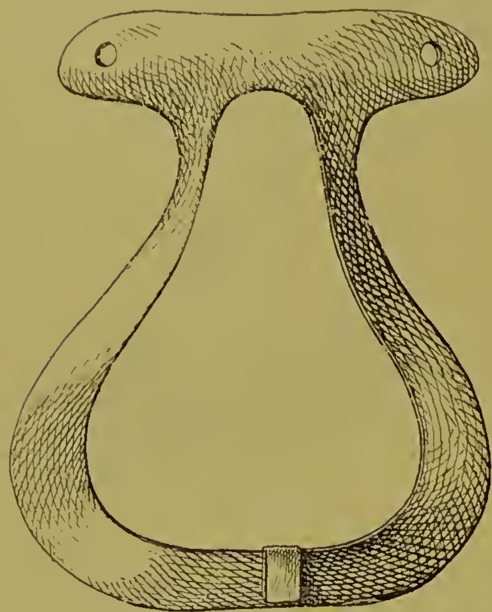
This apparatus, on account of the pressure it exerts and of the reaction of the nasal tissues, has a tendency to go deeper into the fossæ. This, however, is avoided by hooking it to another lyre-shaped apparatus of hard rubber molded on the contour of the nose. (Fig. 4.)

This last instrument is very light, and is held in its place by a small silk bandage tied round the head.

Finally, to the preceding must be added two more instruments used in cases of deviation of the septum, almost invariably found in nasal fractures. One

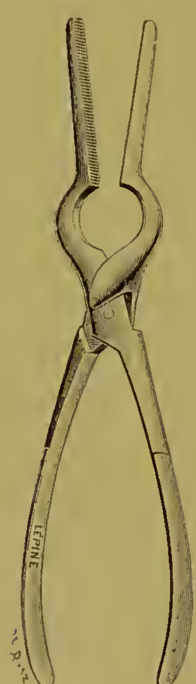
is a forceps to replace the septum, the other to maintain it straight.

Fig. 4.



The forceps (Fig. 5) has large flat bits with which the septum is seized and straightened on exerting pressure on the

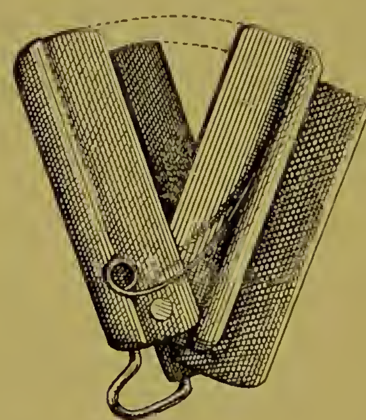
Fig. 5.



handles. After the first apparatus has been worn long enough, in order to maintain the reduction of the septum we introduce into the nasal fossæ an instrument which Claude Martin has already used for a very long time. (Fig. 6.) The following are its main parts:

Two blades of hard rubber are joined at one end by a stiff spring tending to keep them in contact. One blade is introduced into each nostril, thus embracing the septum. Each blade has on its inner border a second rubber blade; these articulate with each other by means of a rivet at their anterior ends. They are movable from below upward and answer

Fig. 6.



to a spring situated at their junction. In short, the upper blade moves upon the lower like the blade of a pocket-knife upon its handle. By this means one can see that (a) the upper spring acts from below upward and thus retains the result obtained by the first instrument of retention, *i.e.* keeps the nasal bones raised; and (b) the lower spring exerts a lateral pressure on almost the whole surface of the septum, thus keeping it straight.

MODUS OPERANDI.

Two distinct stages characterize our process—(*a*) Reduction. (*b*) Retention.

Usually we operate under anesthesia. For recent fractures the short anesthesia obtained by the ethyl-chlorid method is

amply sufficient. For older fractures a longer anesthesia is often necessary, and especially so if osteotomy must first be performed. In fact, Claude Martin has carefully studied this question of badly set fractures, and foreseeing that his lever forceps notwithstanding its strength would not be able to overcome the resistance of the callus, has determined and described, after experimenting on the cadaver, the following process of osteotomy:

Through a single small aperture in the skin a drill worked by the dentist's lathe is introduced. Thus a series of perforations are made subcutaneously on the superior border of the nasal bones as nearly as possible to the naso-frontal suture. Then an incision is made in the nasal mucous membrane along the external border of the nasal bones, and by means of thin shears *ad hoc* these are cut near the naso-maxillary suture, care being taken not to injure the periosteum or the integuments.

The nasal bones only feebly connected with the frontal bone are easily lifted by means of the lever forceps, the small bone bridges between the perforations giving way without difficulty.

We strongly recommend this process of osteotomy for old fractures. The results are perfect. On the one hand no harm is done to the soft parts and hence there is no scar, and on the other hand the artificial line of fracture is made in a definite and determined spot. In fractures four or five months old the lever forceps are amply sufficient, as the callus is not strong enough to resist their pressure.

The patient being still under the effect of the anesthetic, and the osteotomy being over, the lever forceps are introduced. A firm point of leverage is taken on the floor of the nasal fossæ, and by pressure on the handles the movable branch is brought into play and applied to the posterior surface of the nose. Pressure is then exerted until the desired reduction is obtained. The forceps are now withdrawn and the retention apparatus applied.

The application of the retention apparatus is usually easy as long as it be introduced exactly along the axis of the nasal fossæ and its inclination be varied according to the resistances met with.

Once the retention apparatus is in position, all that remains to be done is to fix it to the external apparatus already described. The external lyre-shaped support is held up by a small silk cordon tied round the head.

SUBSEQUENT TREATMENT.

On returning to consciousness the patient has no pain except a slight feeling of tension in the nose, to which he soon becomes accustomed. The usually small hemorrhage caused by the intervention stops spontaneously.

From the first day of the operation, intra-nasal injections of boiled water must be made hourly. The pressure of the injection must be strong and a hard red-rubber syringe should be made use of. These injections carry off the mucous coating, which is rapidly deposited on the instrument, and thus not only is complete asepsis of the nostrils guaranteed, but their obstruction by increased mucous secretions is obviated.

Every five or six days the apparatus is taken out, cleaned, and reapplied. This small operation is sometimes a little painful, and it is often necessary to wait several hours before giving the screw the last twist to bring the pressure up to its

necessary point. This degree of pressure is very well borne by the patient and the adjustment is thus greatly facilitated.

A curious point should be noted: Once the apparatus is introduced there is no more soreness. The nose may be touched without giving rise to any pain.

The retention apparatus is left on about a month. Consolidation is probably complete sooner, but new fractures might arise, as is often the case, on account of the retraction produced by the scar. It is on this account that my father leaves the apparatus in position for about one month. This practice has no inconveniences, the mucous membrane of the nose being very tolerant, thanks to the cleanliness obtained by the repeated douches.

RESULTS.

We shall not dwell at any length on the results of this method. Suffice it to add the two following observations to those already published by Claude Martin:*

Case I. Miss M. (Givors), twelve years old. On January 19, 1904, one of her friends sitting in front of her suddenly dropped her head back, striking Miss M. on the nose and fracturing it. We do not examine her until two months later. At this period a big saddle like depression is manifest and the patient breathes through her nose with great difficulty.

April 12th, anesthesia by ethyl chlorid, reduction, and retention apparatus fixed.

April 30th, apparatus taken off, cleaned, and refixed. A spring instrument is placed about the beginning of May.

May 18th, the nose is doing well, but considering the spring not sufficiently strong, we redress. At the present time the result is perfect.

Case II. Mme. Ch. falls from her carriage on April 22, 1904. Her nose strikes the curbstone violently. There is a fracture of the nasal bones and saddle-like depression.

Reduction performed April 28, 1904. It is noticed that the fracture is constituted of numerous fragments. There is fine crepitation, reminding one of ground egg-shells.

The usual treatment is adopted.

On June 17th we obtain the result I present to you.

Dr. WATSON. The next paper on the program is by Dr. H. A. PULLEN of Buffalo, N. Y.

The paper was as follows:

* See publications on the Nose.

The Great First Class of Malocclusion.

By H. A. PULLEN, D.D.S., Buffalo, N. Y.

As an integral part of this great international dental congress the section of orthodontia owes to it and to the profession at this time an epitome of its progress and its most advanced thought, with the object in view of presenting the most scientific, the most practical, and the most beneficial methods of treatment of malocclusion known to the experienced specialist in this science.

The responsibility falling to the essayist is therefore a great one, and were it not for the enthusiastic confidence in the results obtainable from following out basic principles of occlusion we would be less willing to accept the responsibility, though appreciating the honor conferred.

The importance of the thorough understanding of primary principles in the study of any science cannot be overestimated, for upon certain basic facts de-

pend its evolution through logical deductive methods of reasoning.

The science of orthodontia, with normal occlusion as the basis from which all deductions are made, especially merits the scientific study of those of the profession who appreciate the value of logical inference from general truths.

The theory of occlusion is not yet so old that a repetition of its fundamental principles can be unacceptable to those who are looking for the hidden mysteries in this vast field, for occlusion is the key, the "open sesame," to the realization of the ideal in results to be obtained from treatment suggested by following its teaching.

Feeling that an exhibition of casts of treated cases and photographs of patients before and after treatment according to the ideal in occlusal and facial restoration might be interesting and instructive by way of illustration of the treatment of irregularities of the teeth from the basis of occlusion, the American Society of Orthodontists have contributed some of the best of their work by way of duplicates of casts of treated cases of malocclusion, together with the photographs of patients before and after treatment, and placed them in a collection which may be found in the exhibit room of the orthodontia section, the same to be placed in the National Museum at Washington (after its exhibition here) for preservation and reference.

We feel that the theory of occlusion is of such vast importance to the science of dentistry and especially to orthodontia, that at this meeting, the greatest convention of dentists ever held, is the time when we should consolidate our efforts and concentrate the attention and attract the interest of the whole profession in our work, hoping thereby to increase the general interest in the science of orthodontia and thereby improve its practice by helpful suggestions and criticisms.

Occlusion, then, in all its phases and relationships is the one centralized thought, the objective point in our papers and discussions.

Normal occlusion is the ideal from which we start and which we strive to attain in treatment of malocclusion. It is the basis of the science of orthodontia; yes, and we might well say it is the basis of all dentistry, for it is inclusive of all that is normal and ideal in the dental arch, the perfection of forms and surfaces of the teeth, and the harmonious relations of not only one tooth to its neighbor but of all the teeth in one arch to all of those of the other.

Occlusion must be considered in every step in orthodontia—in diagnosis, prognosis, treatment, retention, and restoration of normal facial lines.

Before proceeding further let us define occlusion, which is the ideal from which and to which the orthodontist works.

Normal occlusion is a condition of perfect relationship existing between the normally formed and aligned teeth of normal dental and alveolar arches of maxilla and mandible, when in antagonism the mandible being in its farthest posterior position, and in perfect median register with the maxilla, and both in normal relationship with contiguous tissues.

Under the absolute conditions of this definition, an existing malocclusion is an irregularity in any position the arches of teeth may assume in their relation to each other except that of normal occlusion. It has been claimed that in full protrusions and full retrusions of the

upper and lower teeth a malocclusion did not necessarily exist, the argument being based no doubt upon the theory that both upper and lower arches were normal in shape and alignment of teeth and that the teeth were still in occlusion or antagonism with interlocking cusps.

But the fallacy of this claim is evident when it is pointed out that a malocclusion is any variation from a *normal* occlusion, not an abnormal occlusion, such as is present in protrusions of either arch.

The loss of but a single tooth from either of these arches would have a very serious effect upon both of them, and would be the beginning of the destruction of occlusion and the forces operating to maintain it. The importance of the individual tooth, therefore, cannot be too strongly impressed.

Extraction for the correction of malocclusion has been in the past altogether too prominent a feature. At present it is contra-indicated, unless the case is complicated by previous mutilation by extraction or some unusual and extraordinary development.

Classification.—The Angle classification for malocclusion is based upon the variation from the harmonious relationship known as normal occlusion, three great classes being represented, the first having normal mesio-distal relations of arches, the second having the lower arch distal to normal in its relation to the upper either unilaterally or bilaterally, the third having the lower arch mesial to normal in its relation to the upper either unilaterally or bilaterally.

The great majority of cases of malocclusion belong to the first class, the second class comprising but a small percentage and the third class a still smaller percentage of the various existing cases of malocclusion.

Diagnosis.—Recognizing a case of malocclusion as belonging to one of the above classes is equivalent to diagnosing it, or in other words it is equivalent to determining the exact extent to which the arches have become altered from normal occlusion, and consequently is indicative of the changes in occlusal relations necessary to restore normal occlusion. The restoration of the latter being the ideal result in treatment, the possibility or advisability of obtaining it in any case of malocclusion may be foretold with a reasonable degree of certainty. Thus prognosis, which in times past was somewhat doubtful in the majority of cases, is now rendered nearly accurate in every case, and that which formerly was a source of never-ending worry is now a pleasure.

Complications by loss of teeth render the diagnosis extremely difficult in some cases, yet a careful study of the changes in occlusal relations as the result of extraction, will reveal the treatment necessary.

The three-class scheme of classification of malocclusion is not an artificial grouping of different varieties of malocclusion based upon the variation of the profile from the normal or the kind of force appliance used, but is a natural grouping of the different forms of malocclusion based upon the variation from the normal of the occlusal relations of the teeth as suggested from the observations of the antero-posterior relationship of the teeth in occlusion.

The facial lines being dependent upon normal occlusion for their normal relationship the occlusion is the prime factor of importance rather than the facial lines.

In the three-class scheme of classification the facial inharmony is only a symp-

tom of the imperfect occlusion, being variable in the first class and of a certain more definite and recurrent type in the second and third classes.

Class I is diagnosed by the normal mesio-distal relationship of the arches of teeth, and the relative positions of the first molars is usually taken as a guide in making the diagnosis of this as well as the other two classes.

In the absence of the first molar by extraction the positions of the teeth adjacent to the space are noted as well as that of the canine if erupted, and the normal relationship mesio-distally determined by some one or two or more teeth on each side of the arch, which being in their normal positions of occlusion give the clue to normal mesio-distal relationship of the arches.

The first molars are the points one would naturally select to determine whether the mesio-distal relationship of the arches of teeth is normal, because of their early eruption into occlusion, at which time they are the only permanent teeth in the posterior part of the mouth which are erupted and capable of retaining the normal occlusal relations during the shedding of the deciduous teeth.

General Treatment—Class I.

The indicated treatment in cases of this class is restoration of normal occlusion by harmonizing the arches of teeth, expanding one or both arches where contracted, bringing all of the teeth into their line of occlusion.

All spaces closed because of premature loss of deciduous teeth or extraction of permanent teeth must be opened to their normal width in order to restore normal size and shapes of the arches, and allow for the eruption of the unerupted teeth or for artificial substitutes where the natural organs have been extracted. Extraction is always contra-indicated, unless an artificial substitute is imperative because of a diseased tooth.

It is necessary to restore the full complement of teeth in both arches in order to get the best results in occlusion and facial lines.

The ideal treatment differing with each of the three classes, as suggested by the study of normal occlusion as the basis of diagnosis of malocclusion, is the restoration of the arches to their normal relationship one with the other whenever possible.

Such treatment includes expansion of arches, contraction of arches, mesial or distal changes in the relations of the arches unilaterally or bilaterally, and the various movements of individual teeth necessary to the restoration of occlusal inclined planes to their normal position. The nearer the attainment of normal occlusion in the correction of any case of malocclusion the less need is there for retention, the normal influence of the inclined planes as well as the other forces governing normal occlusion acting to preserve the positions obtained.

With normal relations of the arches established, the jaws, muscles of mastication, the cheeks, lips, and facial lines will be in best harmony with the type peculiar to the individual, for a perfect profile requires normal occlusal relations.

The appliances used are very simple, being the well-known expansion arch supported by tube or molar clamp bands, accompanied by bands or individual teeth with spur on band and arch so located as to make the application of the force from the ligatures most direct in the line of their movement.

In protrusion of class 1, the Baker anchorage is now used in order to obtain the added assistance of occlusal anchorage in the pitting of one arch of teeth against those of the other, thus forming material assistance and saving much time in treatment.

It is a fact that malocclusion is noted and treatment begun at a very much earlier age than ever before, because of the greater ease with which the operations may be performed on cartilaginous tissues than on solid or semi-solid bone, and because of the less number of teeth to be moved at a period when the first molars and incisors are the only permanent teeth present—as from eight to ten years of age; also, it being the period of development of the oral tissues, the jaws and facial muscles will develop normally if the normal occlusion of the first molars be secured when first erupted and the full space retained for every permanent tooth anterior to them until they are erupted.

If there is one point of more importance than occlusion which I wish to make prominent in this paper it is that of operating during the period of development of the teeth and jaws rather than waiting until the permanent teeth are all erupted and the deformity confirmed in its position by the abnormal development; the greater density of the bone, the increased difficulty and length of the operation, and the distortion of the facial lines in many cases become confirmed also in the abnormal position through habit and abnormal development.

The average age of the patients presenting to the orthodontist is ten or eleven years, and a much earlier age for operating is preferred when it is noted that even at the age of nine many defects in occlusion are seen which might have been prevented if the patient could have been seen at intervals from the time of the eruption of the first molars.

As the far-seeing and up-to-date operative dentist believes in "extension for prevention," the prophylactic specialist in "cleanliness or prophylaxis for the prevention of decay," so the orthodontist believes in "early interference for prevention of malocclusion."

It is a common procedure to correct a developing malocclusion at an early age, before the eruption of the bicuspids or second molars, and to see the same case at intervals until these teeth have all erupted into normal occlusion, thus being assured of the permanence of the result.

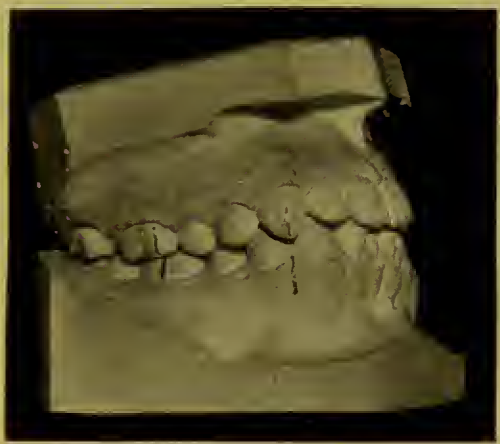
In the first class of malocclusion the teeth may be in any possible position of malocclusion which would be consistent with a normal antero-posterior relationship between the arches of teeth. For example, any of the incisors and canines may be in labial or lingual occlusion, or the bicuspids and molars in buccal or lingual occlusion. There may be protrusions of the anterior part of the upper arch or retrusions of the anterior part of the lower arch without disturbing the normal antero-posterior relationship.

The incisors and canines above and below may occlude normally, while the bicuspids and molars are in malocclusion. Again, there may be a combination of irregularities, such as a protrusion of the upper anterior teeth and a lingual protrusion of the lingual bicuspids and molars. A retrusion of the lower anterior teeth on one side is noticeable in many cases of premature loss of the deciduous molars, also, one side of the arch normal, and the upper or lower teeth on the opposite side in buccal or lingual protrusion.

There are present in this class a num-

ber of etiological characteristics, such as a prolonged retention of the deciduous

FIG. 1.



teeth, the premature loss of deciduous teeth, supernumerary teeth, and other anomalies, abnormal frenum labium, lip-biting and thumb-sucking, although these characteristics are not confined to the class of cases under discussion.

Associated with many of the malocclusions may be found nose and throat troubles, adenoids, enlarged tonsils, and other complications which probably serve as a primary cause for many undeveloped and unformed arches through lack of normal lymph or blood supply and consequent lack of the nutrition necessary to secure normal development.

Fig. 1 illustrates a case in which the normal conditions are present in the relationship of the teeth and jaws, which is designated normal occlusion. Note the normal interlocking of the cusps and bicuspids and molars, and the normal shape of the arches. This is the ideal occlusion which we strive to attain in the treatment of irregularities of the teeth by restoration of the normal shapes of arches and the occlusal planes of the teeth.

Accompanying such perfection of occlusal relations of the teeth is always seen the perfection of profile shown in Fig. 2, being the face mask of the patient from whom the casts in the first figure were taken. Here again is another ideal from which and to which the orthodontist works in the attainment of results. The beautiful lines and curves in the profile are only possible with the arches of teeth in normal occlusion. In other words, the profile in the region of

FIG. 2.

the maxillary zones is dependent upon normal occlusion of the teeth and a normal relation of arches for its harmony and symmetry of contour.

TREATMENT OF SPECIAL CASES.

Fig. 3 represents the right occlusion before and after treatment of an average case of this class, the arches being contracted and the anterior teeth in various positions of malocclusion previous to treatment, and afterward in normal occlusal relation.

The left occlusion in Fig. 4 illustrates the movement of the left central from lingual to normal occlusion and the regaining of the proper space for and restoration, or rather eruption, to normal position of the lower second bicuspid on the left side.

Fig. 5 exhibits the restoration of the normal shape and size of the upper arch, the teeth being placed in the line of occlusion, as noted in the cast on the right of this picture.

Fig. 6 presents the chief difficulties encountered in the case, and the attainment of the same ideal shape of the arch as a final result. The lower unerupted bicuspid very quickly took advantage of its release from imprisonment between the first bicuspid and molar, and erupted into occlusion without mechanical aid and became the keystone to hold the arch intact. Thus we have obtained an harmoniously aligned and occluded denture, and reached the ideal which we desired.

A severe protrusion of class I is illustrated in Fig. 7. At first glance this might be taken for class II, but the normal position of the first molar precludes that diagnosis.

The left occlusion in this figure shows the same normal relationship of first molars. The after-treatment cast on the right of this and the preceding figure

Fig. 3.

Fig. 4.

shows what the expansion arches combined in the Baker anchorage will accomplish.

Figs. 8 and 9. The splendid facial results obtainable in this case justify us in claiming that extraction would have been entirely wrong in the establishment of the ideal in occlusal relations and harmony of profile.

Fig. 10 represents the left occlusion of a case ten years of age, before and after treatment, and the temporary retention of the space for the unerupted canine.

In this case also, if one were to judge by the appearance of the anterior teeth, it might be thought to belong to class III, in which the lower arch is mesial to normal, for the same characteristics are present anteriorly.

The facial lines in Figs. 11 and 12 tell the same story, and unless the occlusion in the molar region were noted a mistake would not have been unlikely in the diagnosis and treatment. The improvement in the facial lines after treatment is very marked, the upper lip being brought out to its proper position and contour.

Restoration of normal occlusion is not always possible in every case of this class, even when the diagnosis seems to indicate it, as illustrated in Fig. 13, which shows the right occlusion of a case in which I found it impossible to find space for or to place in its normal position the upper right lateral incisor. The case looks easier than either of the two previous ones illustrated, in which normal occlusion was restored, but looks are

Fig. 5.

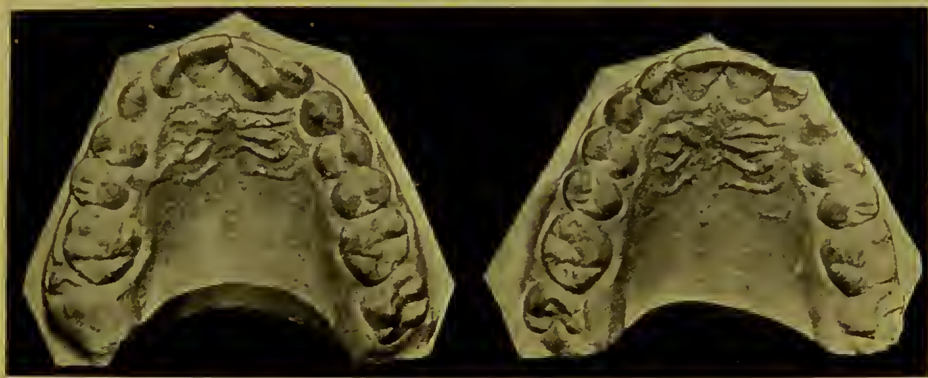
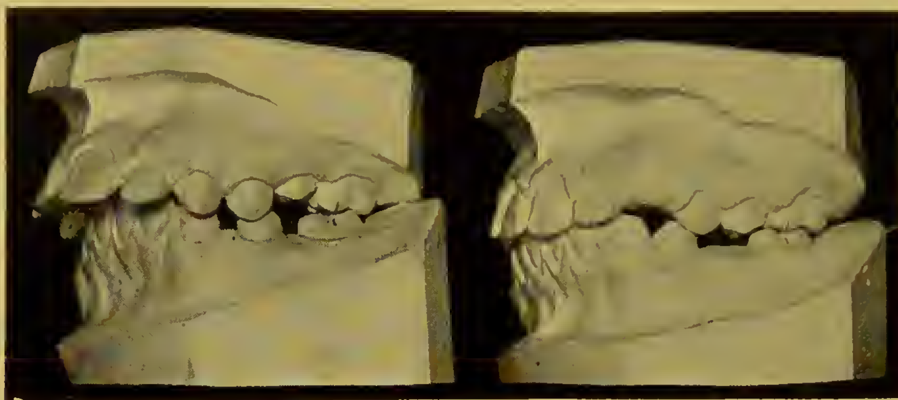


Fig. 6.

sometimes deceiving. The central and canine in the completed case are shown adjacent to each other, and the lateral had to be extracted because of its abnormal shape and position, as will be shown a little later.

FIG. 7.



the condition of affairs, and the malformed lateral is seen on a bit of wax on the left cast. An attempt was made to align all of the anterior teeth except the lateral first, and then it was found that there was not room for it, and the ab-

FIG. 8.

Before treatment.

FIG. 9.

After treatment.

Fig. 14 shows the left occlusion of the same case before and after treatment, but no feature of any importance.

Fig. 15, the occlusal view of the upper casts before and after treatment, pictures

normality was only discovered on its extraction. If I had been able to make space for this lateral I would never have been able to place it in position in the arch. The peculiar bayonet shape of

the root rendered its extraction very difficult.

The most interesting case of any that will be illustrated in this class (Fig. 16) presents certain difficulties of treatment which seemed almost impossible to overcome without a faith in the possibilities of occlusion strong enough to be equal to any emergency or remove any obstacle in the way of accomplishment of the restoration of normal occlusion after having once decided that it was within the range of possibility. The diagnosis of the case may be made from this picture and the next, which shows the right and left occlusion of the case before and after treat-

Fig. 10.

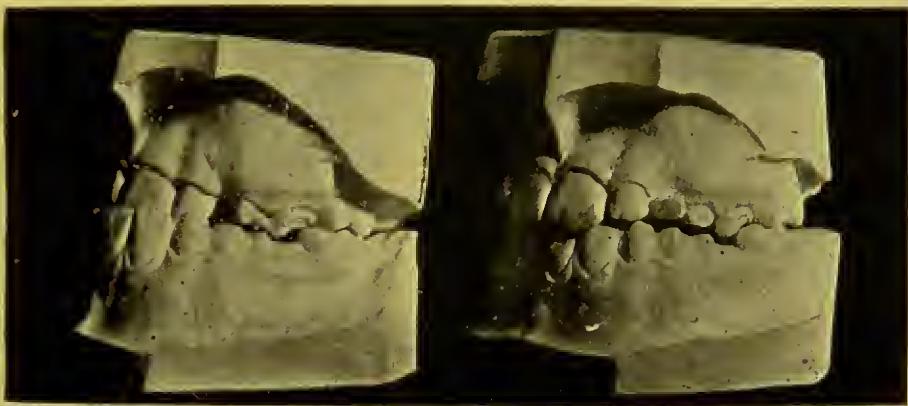


Fig. 11.

Fig. 12.

ment. The case is that of a boy fourteen years of age, and in the model of the right occlusion (Fig. 16, left model) may of the space for the lower bicuspids which have bunched up outside of the arch, as appears.

Fig. 13.

Fig. 14.

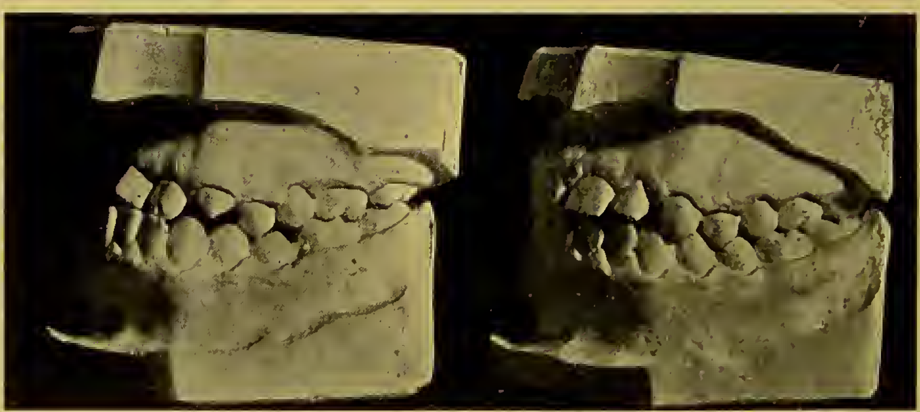


Fig. 15.

be noted the contraction of the arch, the closing up of the space for the upper second bicuspid and the partial closure

The model on the left of Fig. 17 shows the contraction of the arch and the complete closure of the space for the

upper canine and the lower second bicuspid.

Fig. 16 illustrates the right occlusion before and after treatment, and the restoration of normal occlusion.

Fig. 17 shows the left occlusion before and after treatment, and I think it is the best result I can ever hope to obtain. The facial lines are normal, there being no protrusion after treatment, as might have been expected in such a case.

Fig. 18 shows the occlusal view of the upper before and after treatment; in the cast on the left may be noticed the complete closure of the space for the left canine and almost complete closure of the space for the right canine, also the closure of the space for the right second bicuspid, which lies embedded in the process lingually. This view also shows the extraordinary enlargement of the arch for the accommodation of these teeth in the cast on the right.

Fig. 19 shows the peculiar conditions existing in the lower arch (see cast on the left). The two bicuspids on the right

FIG. 16.

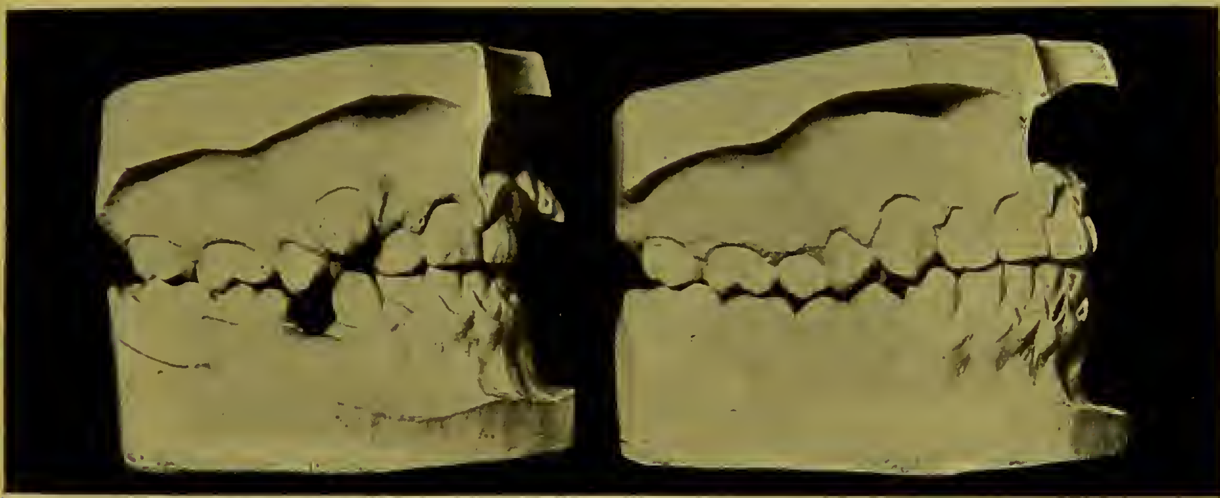
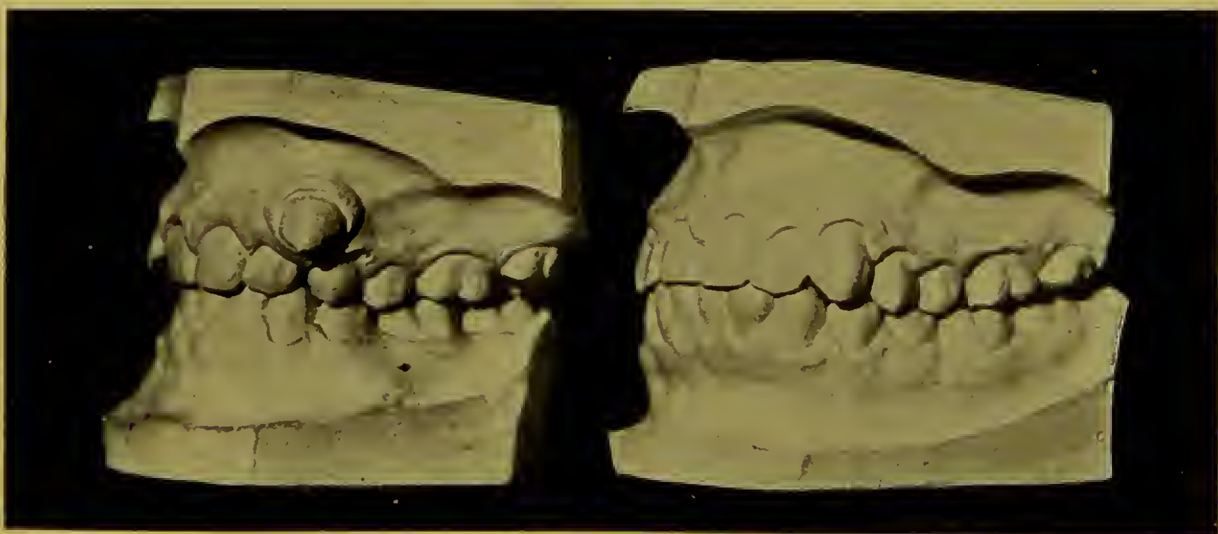


FIG. 17.



side are bunched up buccally, with only half the necessary space for them in the arch. On the left side the space for the second bicuspid is completely closed. The cast on the right illustrates the response to treatment.

Fig. 18.

Fig. 19.

An interesting feature of the case was the eruption of the unerupted teeth almost immediately after space was obtained for them in the arch, and only the slightest traction was needed to bring them into position, nature doing her part grandly when the opportunity was given.

Last, but not least, the retention was the simplest of any case I have ever undertaken of like difficulty. After wearing spur retainers on the canines for about three months all retainers were removed and occlusion was depended on entirely for the permanent retention, and it presents the same appearance today as when completed.

The next picture (Fig. 20) is the after-treatment profile of the face of the last case and illustrates one point very forcibly, *i.e.* that the restoration of extreme cases of this class does not cause

"undue prominence of the *lips*," as suggested by some authors.

FIG. 20.

Fig. 21 is another very difficult case of class I, in which the facial characteristics are very misleading as to diagnosis, for it might be taken for one of class III if the apparently protruding lower arch were taken as a guide. In the treatment it will be noticed that the upper incisors and upper right second bicuspids were all moved from lingual to normal occlusion. The left occlusion, before and after treatment, is shown in Fig. 22. The occlusal view of the upper arch gives one the proper idea of restoration of its normal shape and size.

The front view of the face of the case shown in the preceding pictures is illustrated before and after treatment in Figs. 23 and 24.

The profile in Figs. 25 and 26 shows to still better advantage the restoration of beauty from deformity.

Fig. 27 illustrates the treatment of a very difficult but not uncommon case belonging to the class of cases under discussion, in which it was possible to completely restore normal occlusion by placing all the maloccluded teeth in their normal position of occlusion. The after-treatment cast on the right represents the case two years after treatment. Normal occlusion was depended on for retention of all teeth except the upper canines, which were retained with band and spurs for about one year. The facial result, though not shown here, was particularly pleasing.

FIG. 21.

Figs. 28 and 29 show a case exhibiting some marked peculiarities in the anterior part of the arch. The upper left central incisor was replanted after being knocked out of the arch by a fall, and had to be extracted because its root was completely absorbed, thus necessitating the insertion by the family dentist of an artificial sub-

stitute after the restoration of the space for the central, which had partially closed up. The treatment, though not ideal, was productive of much improvement in the esthetic appearance of the face and mouth.

Fig. 22.

anterior teeth had buckled down against the retruded lower anterior teeth. The space was retained as illustrated in the after-cast on the right, Fig. 31, until the eruption of the second bicuspid into occlusion.

Fig. 23.

Fig. 24

The next picture, Fig. 30, illustrates the regaining of the space for a lower deciduous molar which has been prematurely lost through extraction, and the lower anterior teeth having moved distally and closed up the space, the upper

Fig. 32 shows the occlusal surfaces of the upper and lower casts before and after treatment of a seven-year-old case belonging to class I. In the upper the right lateral was brought into its line of occlusion, while in the lower the four in-

cisors were rotated and retained pending the eruption of the permanent canines and bicuspids, and by occupying their space insure the normal development of the arch.

The next case, Fig. 33, illustrates also the importance of restoration of normal occlusal relations of incisors and bicuspids before the eruption of all the permanent teeth. The lower arch was contracted because of the closing of the space of the lower second bicuspids from premature loss of the premolar, and the upper centrals had dropped back of their normal line of occlusion into a lingual position, touching the lower incisor. By operating at this time, moving the upper centrals and upper lateral into their normal positions in the upper arch and regaining the space for the unerupted lower right second bicuspid, thereby restoring normal occlusal relations of the teeth anterior to the first molars, the normal eruption of the unerupted perma-

FIG. 25.

FIG. 26.

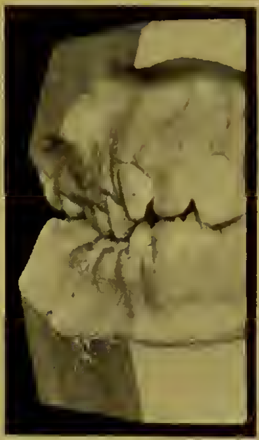
FIG. 27.

nent teeth was assured. The after-treatment cast on the right shows the pleasing result obtained in occlusal relations.

Fig. 28.

Left side of cast.

Fig. 29



Right side after treatment.

There is one other important point illustrated by the picture of this ease after treatment, and that is the retention of the case by the normal locking of the upper in occlusion. The upper right lateral above needed band and spur retention to prevent torsion.

Fig. 30.

Fig. 31.

The next picture, Fig. 34, was borrowed of Dr. Lourie of Chicago, because it illustrated more perfectly than any other I have seen the restoration of normal occlusion in that class of cases exhibiting lack of anterior occlusion to a marked degree. Note the perfect normal relationship of the teeth in the after-treatment cast.

These cases present more difficulties in the restoration of the normal than almost any other class. We find them in class II and III as in class I, but with the added complication of mesial or distal relation of the lower arch to the upper.

Fig. 32.

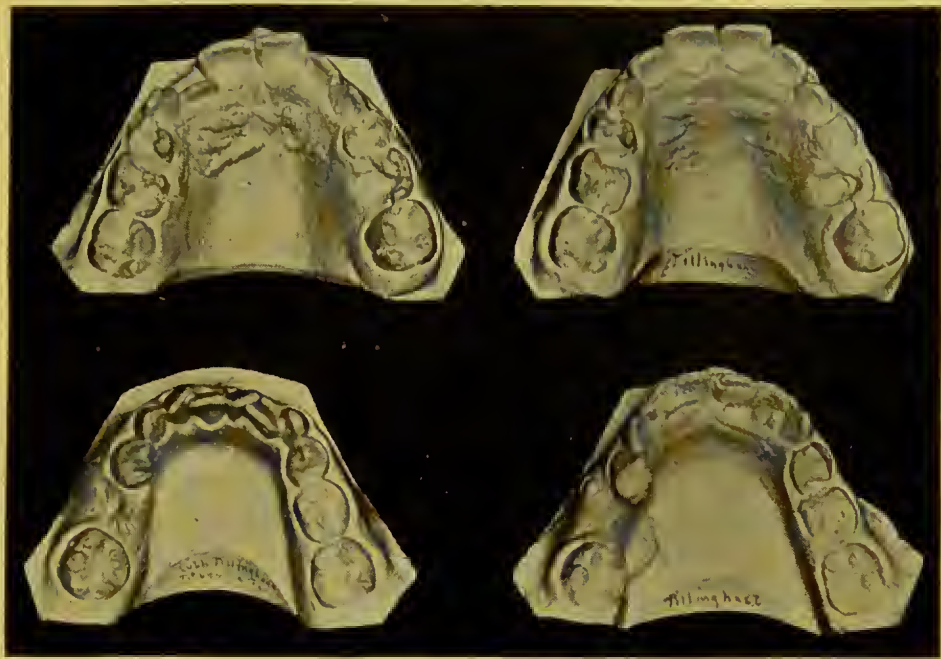


Fig. 33.

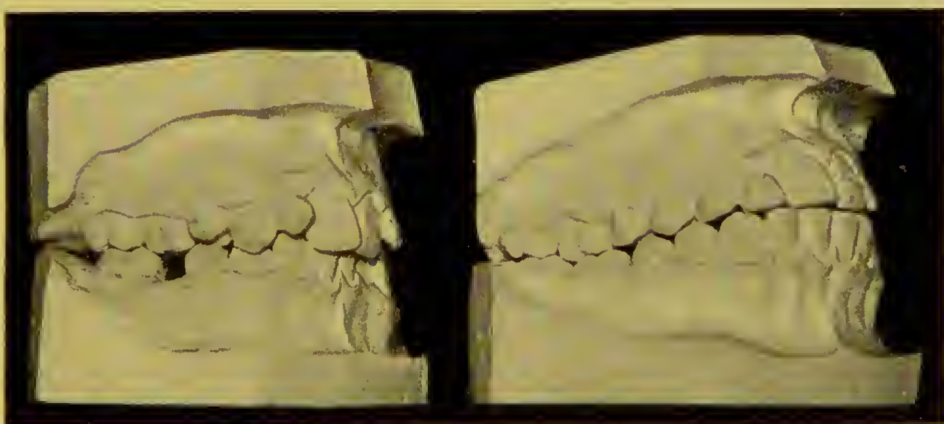
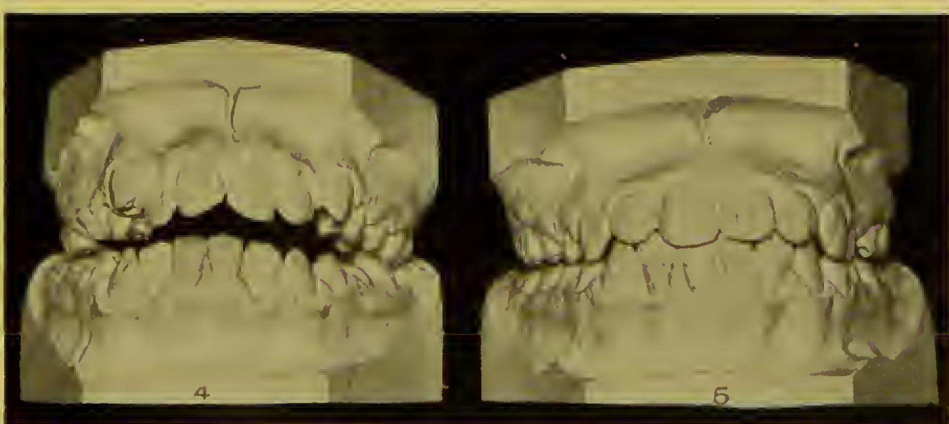


Fig. 34.



As might be inferred from the variation of the cases illustrated, a great many more might be included exhibiting a greater or less degree of malocclusion in this class, but time and space forbid more than the illustration of the more common types presenting in practice which I have attempted to portray.

Probably the history of class I cases will never be completed, but of whatever degree of variation from the normal in the anterior part of the arches, if these cases present normal mesio-distal relationship they fall under the division of the classification which I have undertaken to elaborate, and are, in the large majority, amenable to successful treatment in the restoration of the normal conditions of occlusion.

Without doubt, at the next international dental congress the science of orthodontia will have made such progress that we will be able to overcome still greater difficulties in treatment and solve more complex problems in occlusal restoration than at present, and with even greater facility than is possible with our present knowledge of the correct principles of occlusion and the exact application of mechanical principles suggested by its teachings.

Discussion.

Dr. L. S. Lourie, Chicago, Ill. I wish to say a word of commendation, for I think we all appreciate the paper and the collection of results and cases that have been shown. It widens the possibilities in treating extensive cases of class I. Probably there are very few cases more difficult than those which have been shown on the screen, and the results are such as to encourage one in the attempt to correct even the most difficult cases of class I. I think one of the most important points brought out clearly by the essayist was the necessity of retaining the spaces between the deciduous teeth. In other words, when the deciduous teeth have been lost, that space must be retained. The arch must be enlarged to restore the space that would have been preserved by the deciduous teeth. It shows the results of the loss of the deciduous teeth by either caries or extraction. And that one point alone would make the paper very valuable. In the remarks and illustrations the essayist has clearly shown the necessity for treatment in such cases, and I wish to emphasize the remarks made in this paper.

Dr. H. D. Keeler, Des Moines, Ia. There was one case where the lateral was extracted, and I didn't exactly understand why, and I would like to have the essayist explain his reason for that.

Dr. Lourie. I want to make a remark in addition to the one Dr. Keeler has made. I have not examined that case thoroughly enough to know whether it would really have been impossible to regulate the tooth in this instance, but I think we might attempt to correct malposition of the teeth even though they have twisted roots. I do not think a twisted root itself should cause us to fail to attempt treatment. If the tooth were so far out of line that it could not be placed in normal occlusion, that is a difficult matter, but I believe the twisted root should be moved if the root itself is not too far out of its normal position.

Dr. Pullen (closing the discussion). There was one point spoken of—about the lateral. I did not deem it possible to get the lateral in the arch without

making the upper arch larger than the lower. I gave it up after trying, and extracted it.

Dr. Watson. The next paper is by Privatdocent Dr. Schroeder, on prognathous forms and their orthopedic treatment. I have the pleasure to introduce Dr. Schroeder to you.

Privatdocent Dr. Hermann Schroeder of Greifswald, Germany, responded and read the following paper in the German language:

Die Prognathie: Eine Zahnarztliche Studie.

Von Privatdocent Dr. HERMANN SCHROEDER, Greifswald, Germany.

Unter Prognathie im weitesten Sinne ist das Hervortreten der Kiefer und der von ihnen beherrschten Teile des Kopfes zu verstehen; im allgemeinen aber fast man den Begriff Prognathie im engeren Sinne als das Vorstehen des Oberkiefers und der von ihm direkt abhangigen Teile des Gesichtsschädels auf, während man das Hervortreten des Unterkiefers als Pragenie bezeichnet. Damit ist aber keineswegs gesagt, dass die Prognathie des oberen Gesichtes für sich allein zu studieren wäre, vielmehr ist es für die richtige Beurteilung prognather Formen von der grössten Bedeutung, den Unterkiefer hinsichtlich seiner Form sowie seiner Lagerung zum Oberkiefer sorgfältig zu berücksichtigen.

Der Prognathismus ist ein vielbesprochenes und umstrittenes Thema, gleich interessant und wichtig für den Arzt, speciell für den Zahnarzt, wie für den Anthropologen. Für den Zahnarzt insofern interessant, als die Entwicklung des Prognathismus vielfach auf das Innigste verknüpft ist mit der Entwicklung der Zähne und der Formgestaltung des Gebisses. Die Kräfte, die während des Zermalmens der Speisen innerhalb der Mundhöhle zur Entwicklung gelangen, sind zweifelsohne in ihrer Ausdehnung und Wirkung bisher unterschätzt; sie wirken intensiv ein auf Form und Lagerung der Zähne und somit auch auf die Position und Gestalt ihrer Matrix, auf den Alveolartheil der Kiefer; vielfach sogar kann man ihren einfluss erkennen in der Formation des Kieferkörpers.

Prophylaxe und Therapie und im Anschluss daran die Aetiologie des Prognathismus interessiren den Zahnarzt besonders und haben Veranlassung gegeben zu den verschiedensten Behandlungen des Gebisses während seiner Entwicklung, speciell während der Zeit des Zahnwechsels, deren Resultate in der Umgestaltung der Lagerung der Zähne und des Alveolartheils und somit in häufig bedeutenden Veränderung der Gesichtsconturen begründet sind. Wichtiger noch, weil vielfach grundlegend für die Einteilungssysteme des Menschengeschlechtes, ist der Prognathismus der anthropologischen Wissenschaft geworden. Den Anthropologen erschien das Vortreten des Gesichts von jeher bis auf die letzte Zeit bestimmt zu sein, als ein gegebenes Rassenmerkmal zu dienen.

Und doch ist der Prognathismus stets das Schmerzenskind der Anthropologen gewesen. Zu einer wissenschaftlichen

Ausnutzung dieses Begriffes genügte eben nicht die blosse Beobachtung der verschiedenen Wachstumsverhältnisse, die immer leiden musste unter einer individuellen Anschauung, es war vielmehr nötig, eine grenze festzulegen zwischen normal und vorstehend, um auf diese Weise einen sicheren Anhaltspunkt für die Constatirung des Prognathismus zu gewinnen und zugleich den Grad desselben zu bestimmen.

Es ist aber eine schwer zu erfüllende Aufgabe, auch nur annähernd eine allgemein geltende Grenze anzugeben. Sie hat die Ersten der Anthropologen intensiv beschäftigt und hat Veranlassung zu den verschiedensten Arten der Beobachtung und Messung der Gesichtsdimensionen im Sinne des Prognathismus gegeben.

Man war bestrebt, auf diese Weise ein Material zu gewinnen, das unabhängig von der Disposition der Beobachter ist und gesammelt und geordnet zu Vergleichen und Schlussresultaten führen könnte.

Ich muss bekennen, dass mir nach gründlichem Studium der einschlägigen Litteratur die Definition und die Gradbestimmung der Prognathie nicht als gesichert erscheint, da die Verhältnisse, von denen der Grad derselben abhängig sein soll, in ihrer Wichtigkeit verschieden geschätzt und demgemäss bei der Festsetzung der einzelnen Masssysteme sehr ungleich behandelt sind.

Die Auffassung des Prognathismus zahnärztlicherseits, die vor allem begründet ist in dem gegenseitigen Verhältniss der beiden Zahnreihen zu einander, hat ihre Berechtigung insofern als dieses Verhältniss auf die Form der Kiefer und deren Lagerung zum Hirnschädel nicht ohne Einfluss bleibt, dann aber ist es klar, dass ein Begriff sich den Zielen und Zwecken eines Faches anbequemt und in dessen Sinne behandelt wird.

Wenn daher in der zahnärztlichen Litteratur die verschiedenen Grade des Prognathismus vielfach von dem Abstande der oberen Zahnreihe von der unteren abhängig gemacht werden, wenn also das Verhältniss der Zahnreihen zu einander bei der Bestimmung des Prognathismus eine bessere Berücksichtigung findet als die Lagerung des Gebisses zur Schädelbasis und zum Hirnteil, so ist das zwar eine einseitige, aber durchaus leicht erklärliche und vor allen Dingen zweckmässige Auffassung.

Zweckmässig insofern, als sie für die praktische Behandlung der Prognathie viele Anhaltspunkte schafft; zur exacten Fixirung dieses Begriffes als kraniologisches Merkmal kann sie jedoch nur unterstützende und aufklärende Momente bieten.

Als kraniologisches Merkmal, das vor allen Dingen dazu dienen soll, die Unterschiede der Conturen des Gesichtsprofils in anschaulichen und vergleichbaren Zahlenwerten auszudrücken und so durchgreifende Unterschiede zu begründen, musste der Prognathismus und seine einzelnen Grade auf das Verhältniss der Kiefer zum Gesichtsschädel bezogen werden, und hier wiederum musste man möglichst fixe, durch Vorgänge secundärer Natur nicht verschiebbare Punkte finden, von denen die Messung ausging.

Die zum Zwecke der Gradbestimmung des Prognathismus am Gesichtsschädel seitens der Anthropologen ausgeführten Winkelmessungen sind in ihrer Anlage grundverschieden, und ihre Ergebnisse können infolgedessen nicht untereinander verglichen werden.

Es liegt nicht im Interesse meiner Arbeit, die verschiedenen Beobachtungs und Messungs-verfahren, die alle darauf

hinauslaufen, die Stellung bezw. das Verhältniss der Kiefer zu dem übrigen Gesicht zu bestimmen, eingehend zu erörtern, ich will sie nur insoweit berücksichtigen, als sie für meine Besprechung von Bedeutung sind.

Das Vorspringen und Zurücktreten der Zähne und Kiefer hat entschieden den wichtigsten Einfluss auf die Gesichtsbildung, ich halte es aber für nicht berechtigt, in diesem Verhältniss der Zähne und Kiefer und in der daraus hervorgehenden Gesichtsbildung von vornherein besondere Rasseneigentumlichkeiten zu erblicken und dieselben als angeboren zu betrachten; wenigstens sind die Zähne und mit ihnen die Alveolarfortsätze, wie ich das später nachweisen werde durch Vorgänge secundärer, vielfach functioneller Natur in ihrer Form und Stellung sehr beeinflusst und daher variabel.

Da aber die Lagerung und Ausbildung dieser Teile die Grösse jenes Winkels bedingt, den man als Gesichtswinkel bezeichnet, so ist leicht einzusehen, dass ein ganz unberechtigter Stolz darin liegt, den grössten Gesichtswinkel, wie er sich relativ häufig findet bei unserer Rasse, mit dem höchsten Grade der Intelligenz zu verbinden.

Dem orthognathen Gesicht gegenüber, das wir als unser Privileg betrachten und das wir auch deswegen als das normale bezeichnen, ist der Prognathismus, mag er auch noch so verschiedenartig sein, als ungünstig und einem niederen Typus entsprechend angesehen.

Die orthognathe Form, festgelegt in bestimmten Verhältnisszahlen bietet gewöhnlich den Ausgangs- und Vergleichungspunkt für anders geartete Typen und so auch für den Prognathismus.

Gegen die Annahme geringer geistiger Entwickelung bei gleichzeitig vorhandenem Prognathismus sprechen von vornherein schon ganz allgemein Erfahrungen.

Wir wissen, dass die genialsten Köpfe nicht selten einen übermässig spitzen Gesichtswinkel aufweisen, andererseits steht fest, dass sich unter den niedrigsten Rassen häufig genug ausgesprochene Geradwinkler befinden. Auch deutet schon die oberflächliche Beobachtung von Köpfen an denen die Zähne noch nicht zum Durchbruch gekommen oder bereits seit längerer Zeit geschwunden sind, darauf hin, dass der Grad der Intelligenz mit der Grösse des Profilwinkels nichts gemein haben kann.

Ueberblickt man das, was bereits über den Prognathismus ausgesprochen und niedergeschrieben ist, so findet man, wie bereits angedeutet, dass dieses Thema grundverschieden aufgefasst und dementsprechend behandelt worden ist.

Verhältnissmässig wenig darüber ist zu finden in den Handbüchern der normalen und pathologischen Anatomie, während in anthropologischen Schriften sich zahlreiche Angaben und Erörterungen finden, die allerdings fast alle die anthropologische und ethnologische Seite des Themas vorkehren.

Auch in der zahnärztlichen Litteratur finden wir belangreiche Angaben, wir empfinden es aber auch hier als einen grossen Missstand, dass die Zahnheilkunde von jeher zu selbstständig und nicht im Anschluss an die übrigen in Betracht kommenden Disciplinen vorgegangen ist.

Dass infolge der verschiedenen Beobachtungs- und Auffassungsweise die Ausbildung eines einheitlichen Systems und einer annähernd gleichmässigen Nomenklatur zu den Unmöglichkeiten gehört, ist leicht verständlich.

Vielleicht bietet sich aber eine bequeme Art der Vermittlung auf Grund

einer Auffassung, die zunächst allgemein gehalten, weder die eine noch die andere Richtung bevorzugt, die also zunächst indifferent ist und mit Vorteil im Interesse der in Betracht kommenden Disciplinen und unter Berücksichtigung und mit Hilfe der durch sie bereits gelieferten Ergebnisse zu weiterer und eingehender Ausführung gelangen kann.

Beim Studium der Gesichtsbildung, besonders beim vergleichenden Studium seniler und jugendlicher Schädel empfindet man leicht, dass Kiefer und Zähne die architektonische Grundlinien für die Form und den Ausdruck des Gesichtes bilden.

"Es besteht kein Zweifel,"—sagt Zuckerkandl—"dass ein im wahren Sinne schönes Gesicht nur unter Voraussetzung einer edlen Bildung des Kiefergerüstes denkbar ist."

Das natürlich hervortretende Merkmale und Formen an ihnen, besonders dann, wenn sie als Abweichungen von der Norm deutlich und kräftig ausgeprägt sind, auffallen und eine besondere Rolle spielen bei der Beobachtung und dem Studium der Gesichts- und Schadelbildung ist leicht einzusehen.

Besonders das Vorspringen der Kiefer hat die Aufmerksamkeit der Beobachter frühzeitig gefesselt, so dass diese Formation eng mit der Geschichte der Kraniologie verknüpft ist.

Dies ist schon deswegen verständlich, weil es kaum ein kraniologisches Merkmal giebt, das so wie die stark nach vorwärts geneigte Richtung der Kiefer den menschlichen Gesichtstypus dem tierischen speciell dem der höheren Quadrumanen zu nähern scheint.

Man versteht leicht die Annahme, dass in den Conturen des Gesichtsprofils unterschiedliche Maasse in vergleichbaren Zahlenwerten gegeben seien.

Mit dieser Auffassung entwickelten sich die verschiedenen Beobachtungs- und Messungsverfahren, die fast alle darauf hinauslaufen, den Grad der Prognathie in Rücksicht auf eine Normale zu bestimmen.

Reichlich hundert Jahre ist man mit dieser Frage beschäftigt, deren vielseitige Erledigung manche interessante Momente darbietet.

Peter Camper* hat als erster die Frage des Prognathismus in systematischer Weise behandelt; er fand in der Grösse des Gesichtswinkels den Maasstab für den edleren Gesichtsausdruck.

Den Gesichtswinkel bestimmte er durch zwei Linien, durch eine horizontale, die vom Gehörgange längs dem unteren Teil der Nase verläuft, und eine zweite, die vom hervortretenden Teil der Stirn in der Medianebene zur Vorderfläche des Oberkieferalveolarfortsatzes geht.

Mit der Construction dieses Winkels wollte Camper nicht ein ethnologisches Unterscheidungsmerkmal schaffen, sondern er hatte lediglich die Vorstellung "des gefallenden Schönen" im Auge.

Formation der Kiefer, Bildung der Zahnbögen und Stellung der Zähne hat er ausser Acht gelassen.

Er ging vielmehr aus von der Bestimmung des Gesichtsausdrucks am Lebenden, der ihm durch Stirn und Oberlippe gegeben zu sein schien.

Diese Auffassung genügte Joh. Fr. Blumenbach† der stets bestrebt war, auf gewissen gleichmässig beobachteten Merkmalen eine Rasseneinteilung der Menschen zu begründen, durchaus nicht, er erkannte den Wert des Camperschen Ge-

* Ueber den natürlichen Unterschied der Gesichtszüge des Menschen. Berlin, 1792.

† De generis humani varitate nativa. Göttingen, 1775.

sichtswinkels für die Rassenbestimmung nicht an, richtete vielmehr wie auch seine Nachfolger bei der Einteilung der Menschen in Rassen seine Aufmerksamkeit vorzüglich auf die Gestaltung des Schädeldaches, liess dabei jedoch die Stellung und Formation der Kiefer und Zähne nicht ganz ausser acht.

So giebt er dem Kaukasier rundlichen Zahnrandbogen und senkrecht stehende Schneidezähne des Oberkiefers, während er den Mongolen breitgewölbte Zahnrandbögen an beiden Kiefern, den Malayen einen hervorragenden Oberkiefer zuschreibt. Von den Aethiopiern erwähnt er, dass die Zahnrandbögen mehr zugespitzt und vorragend und die Schneidezähne schräg gelagert seien.

Er differenziert bereits die Stellung des Alveolarteils und der Kiefer und erwähnt auch das Verhältnis der oberen Zahnreihe zur unteren, schwerlich hat er aber den Zähnen und ihrer Function einen bestimmenden Einfluss auf die Ausbildung des Antlitzes zugemutet.

Das Hervortreten beider Kiefer, wie speciell des Oberkiefers ist ihm ein nicht zu unterschätzendes Merkmal, aber er isolirt diese Formation nicht und fixirt sie noch nicht durch eine besondere Benennung, wie nach ihm Pritchard* der dafür den Ausdruck "Prognathismus" einführte und die Beschaffenheit der Kiefer als Hauptunterscheidungsmoment bei seiner ethnologischen Einteilung benutzte, indem er der ovalen Schädelform der Europäer und der pyramidalen der turanischen Völkerschaften die prognathie der Negerstämme als dritten Typus entgegenstellt.

Die Prichard'sche Auffassung verband mit dem Begriff "prognath" vorstehende Kiefer und im Zusammenhang damit schräg nach vorn geneigte Zähne.

Prognath gebildete Kiefer schliessen danach die Schiefzähnigkeit ein, eine Annahme, die sich vielfach erhalten hat, was dadurch verständlich wird, dass sehr häufig beide Begriffe zusammenfallen.

Noch weiter ging in dieser Beziehung der schwedische Anatom Retzius* der nachdem er den Begriff "prognath" auf alle Schädel ausdehnte, bei denen der Oberkiefer nach vorn ragte, ihn als gleichwertig mit "schiefzähnig" gebrauchte.

Gleichzeitig führte er für Schädel mit Gerader oder dem Geraden sich nähernder Profillinie "die Bezeichnung orthognath" ein. Die lotrechte Profillinie ist wie Retzius meint bedingt durch eine "verhältnismässige Mattigkeit der Kiefer und Jochbeine sowie der Alveolarfortsätze und der Zähne."

In neue Bahnen gelenkt wurden die Beobachtungen und Untersuchungen über den Prognathismus um die Mitte dieses Jahrhunderts durch die Arbeiten Virchows† und Welchers.‡

R. Virchow hatte zuerst den Gedanken ausgesprochen, dass der Prognathismus des Gesichtsschädels abhängig sei von der Gestaltung des Schädelgrundes. Welcker führte aus, dass das Vorspringen der Kiefer mit der Gröse des Sattelwinkels wächst. Die Grösse dieses Winkels bestimmte er durch ein Dreieck, dessen eine Seite der Entfernung der Nasenwurzel zum Sattel, dessen zweite dem Ab-

* Researches into the Physicial History of Mankind. London. 1813.

* Ueber die Form des Knochengerüstes des Kopfes bei den verschiedenen Völkern. Müller's Archiv 48, p. 270.

† Virchow: Untersuchung über die Entwicklung des Schädelgrundes. Berlin, 1857.

‡ Hermann Welcker: Untersuchungen über Wachstum und Bau des menschlichen Schädels. Leipzig, 1862.

stand des Sattels vom vorderen Rande des Hinterhauptloches, dessen dritte der Linie vom letzteren zurück zur Nasenwurzel gleich ist.

Dieser Winkel, der nur an Sagittalschnitten messbar ist, steht zu einem anderen Winkel des Gesichtes in Wechselbeziehung, der an der Nasenwurzel liegt und sich an allen Schädeln mit Hilfe eines Dreiecksmessen lässt, dessen Seiten entsprechen den Abständen von der Nasenwurzel bis zum vorderen Rande der Hinterhauptsöffnung von dieser bis zum Ansatz der Zahnfächer und endlich von diesem zurück nach der Nasenwurzel.

"Offenbar"—sagt Peschel*—"ist es der Winkel an dem Beginn der Zahnfächer der den Gesichtsausdruck beherrscht und mit dessen Grösse sich in unsern Augen das Antlitz veredelt. Welcker hat indessen vorgezogen, die Kieferstellung mittelbar durch den Winkel an der Nasenwurzel zu bestimmen, weil dieser letztere einerseits mit dem Sattelwinkel zu wachsen pflegt, andererseits der Winkel an den Zahnfächern sich umgekehrt verhält, nämlich abnimmt, wenn jene anderen wachsen."

Ich möchte nur kurz dazu bemerken, dass mehr noch als der Subnasalwinkel der Winkel am unteren Zahnfächerrande oder auch an den Schneiden der Frontzähne das Profil beherrscht. Es ist anzunehmen, dass irgend welche Gründe Welcker bewogen, bei Bestimmung der Kieferrichtung die Zirkelspitze über den Zahnfächern anzusetzen und so Alevolartheil und Zähne von der Messung auszuschliessen.

Vielleicht hat er den Missstand, dass sehr viele unter den ihm zur Verfügung stehenden Schädeln gerade im Bereiche des Alveolartheils defekt waren, umgehen wollen.

Erklärlicher aber erscheint mir die Annahme, dass Welcker den Prognathismus, der durch Form und Lagerung der nicht berücksichtigten Teile erzeugt wird, auf ganz unwesentliche Wachstumsrichtungen zurückführte.

In der That legte Welcker wie auch Virchow nur Wert auf die Unterschiede in der Stellung des Oberkieferapparates zur Schädelbasis, er musste also den Alveolarfortsatz unbeachtet lassen, denn von einer Axe des Oberkiefers kann keine Rede mehr sein, wenn der Alveolartheil in die Messung eingeschlossen wird. Andererseits aber hat Welcker den Nasofrontal- und den Subnasalpunkt als fix angenommen, er dürfte sie in ihrer Position nicht für anhängig halten von der Einstellung der Zähne und der Bildung ihrer Matrix.

Entgegen dieser Anschauungsweise möchte ich gleich hier betonen, dass der "Zahnprognathismus" durchaus nicht als etwas "Zufälliges" angesehen werden darf und dass er wenigstens bei den Massen, die an der Spina nasalis inferior ihren vorderen unteren Endpunkt haben, nicht unberücksichtigt bleiben darf, da wie wir sehen werden, der Subnasalpunkt und höchst wahrscheinlich sogar der Nasofrontalpunkt durch die Ausbildung und Function des Gebisses in ihrer Lagerung beeinflusst werden.

Bemerkenswert ist noch, dass Welcker auch das Verhältnis der Kiefer zur Stirn berücksichtigt. Er sagt: "Flache Stirn ist eine Begleiterin der Prognathie, aber die Prognathie liegt nicht in der Stirn."

Er tritt damit in Gegensatz zu seinem Vorgängern insbesondere zu Lucae, der den Begriff "prognath" direkt abhängig macht von einem Vortreten des Gesichtes im Verhältnis zur Stirn.

* Oskar Peschel: Völkerkunde, Leipzig, 1877, p. 77.

So sagt er*: "Wie die vollkommen Ausbildung der Stirn die orthognathe Form begünstigt, so wird die prognathe Form durch das Vortreten der Kiefer befördert."

Das Wesen der Prognathie erblickt Lucae nicht in dem Vortreten der Kiefer, das nach ihm nur als ein sie begünstigendes Moment aufzufassen ist, er hält vielmehr die Wölbung und Steilheit resp. die Flachheit der Stirn für ausschlaggebend.

Um so auffallender ist es, dass Lucae einen Prognathismus erkannte, der in der Bildung des Oberkiefers überhaupt liege und einen solehen, der nur dureh den Alveolarfortsatz bedingt würde.

Ein Abhängigkeitsverhältnis der beiden Formen von einander hat er entschieden nicht angenommen, vielleicht aus dem Grunde, weil vielfach eine ausgesprochene prognathe Stellung der Zähne und des Alveolartheils einhergeht mit einer orthognathen Stellung des Mittelgesichtes. Wie wir aber später sehen werden, resultirt diese in vielen Fällen aus der Alveolarprognathie.

Auch R. Virchow† weist gelegentlieh der Besprechung der Schädel von Silberberg darauf hin, dass der Prognathismus nicht als streng einheitlieher Begriff anzusehen, dass der rein alveolare Prognathismus von dem des Mittelgesiehts zu unterscheiden sei.

Es entspricht seiner Auffassung wenn Zähne und Alveolartheil bei der Gradbestimmung der Prognathie, soll sie ethnologisch von Wert sein, von der Messung ausgeschlossen bleiben.

* Lucae: Zur Morphologie der Rasseschädel in der Abhandl. der Senkenbergschen Naturforschenden Gesellschaft. B. V. Frankfurt a/M. 1865.

† R. Virchow: Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte. VI. 213.

H. v. Ihering* dagegen glaubt nur brauchbare Resultate zu erzielen vermittelst eines Maasssystems, dass diese Teile vollkommen einschliesst.

Ihm ist der Winkel ausschlaggebend, den die von der Nasenwurzel zur Mitte des Alveolarfortsatzes des Oberkiefers gezogene Profillinie mit der Horizontalen bildet, die die Mitte der Ohröffnung mit dem unteren Rande der Augenhöle verbindet. In ganz ähnlieher Weise ging Falkenstein vor.

Bemerkenswert ist, dass englische und französisehe Autoren, wie Geoffroy Saint Hilaire, Cuvier, Jules Choquet, Jarquart und Flower den Gesiehtswinkel gemessen haben unter voller Berücksichtigung des Alveolartheils und der Zähne.

Nieht unerwähnt bleiben darf Topinard, der bestrebt war, den Prognathismus möglichst zu analysiren und ihn dann für ethnologische Zwerke zu definiren.

Das Wesentliche, was Topinard† p. 276. ff. seiner Anthropologie angiebt, ist folgendes:

"Prognathismus bezeichnet seit Prichard für alle Welt die Verlängerung und das Vorstehen der Kiefer oder auch ihre Schrägheit, die bei den schwarzen Rassen Afrikas und Oceaniens gewöhnlich ist und sich gelegentlich auch bei Europäern findet. Im Profil gesehen, fällt er sowohl beim Lebenden als auch am Schädel von selbst auf; man fällt in Gedanken eine Senkrechte von der Nasenwurzel oder vorn von Spina nasalis, und je nach dem die vor dieser Senkrechten liegende Partie gross oder klein ist, nennt man das Subject prognath oder nicht. Nichts ist einfacher. Indessen findet sich die Be-

* Siehe S. 69 seiner Abhandlung im Archiv. f. Anthrop. V.

† Topinard, Dr. Paul: Anthropologie. Deutsch von Dr. Richard Neuhaus, Leipzig, 1888.

zeichnung bei den Verfassen in verschiedener Bedeutung gebraucht. Die Einen sprechen von Prognathismus des Gesichts, die Andern von dem der Kiefer; wieder Andere gehen so weit, dass sie alles unterhalb der Nasenlöcher Liegende ausnehmen und nur die Partie des Oberkiefers meinen, die zwischen Nasenwurzel und dem unteren Rande der Spina nasalis liegt."

Die Arten der Prognathie des oberen Gesichtes, die er zulässt, sind folgende:

Prognathie:
1. des ganzen oberen Gesichtes,
2. des Oberkieferbeins,
3. der Partie zwischen Alveolar- und Subnasalpunkt,
4. der Oberzähne.

Einen selbständigen dentalen Prognathismus weist er ganz von der Hand, wie aus folgenden hervorgeht:

"Da die Zähne vom Skelett unabhängige Organe sind und in demselben wachsen, wie die Haare in der Schädelhaut, müssen sie bei Seite gelassen werden? Grade oder schräg zeigen sie im Allgemeinen dieselbe Richtung wie die Alveolen, in denen sie sitzen. Wenn bei ihnen überhaupt ein special Prognathismus vorhanden ist, so harrt er noch dessen, der sich mit ihm beschäftigen will."

Nachdem Topinard sodann die noch in Betracht kommenden drei ersten Arten der Prognathie einer eingehenden Kritik unterzogen hat, stellt er als Resultat seiner Betrachtung die Behauptung auf, dass die Prognathie des ganzen oberen Gesichtes als ethnologisches Merkmal zu verwerfen sei, dass das Hervortreten des ganzen Oberkieferbeins dann und wann einigen Aufschluss gebe. Als wirklicher Prognathismus komme jedoch nur das Vorstehen der Region Alveolar Subnasalpunkt in Betracht. Mit ihr habe man allein zu rechnen, wenn man die Herkunft eines Schädels bestimmen wolle, nur sie liefere das gesuchte unterscheidende Markmal der menschlichen Rassen. Über Formation und Richtung der Zahnwurzeln, über Wirkung der Funktion des Gebisses, wie auch über das Verhältnis der beiden Zahnreihen zu einander macht Topinard keine besonderen oder bemerkenswerten Angaben.

Die Art des Zusammentreffens der Zahnreihen ist aber nicht immer unberücksichtigt geblieben von Seiten der Anthropologen und die Beobachtung ihres gegenseitigen Verhaltens hat meiner Ansicht nach die Varanlassung gegeben zur Differenzirung einer pathologischen und einer physilogischen resp. ethnologischen Form der Prognathie. Man hat allerdings nicht stricte die Art des Zusammentreffens der Zähne, wie sie sich beim normalen oder regelmässigen Biss findet, als Richtschnur bei der Abgrenzung physiologischer und pathologischer Formation Benutzt.

Von einzelnen Autoren werden gewisse Abweichungen vom Typus des normalen Bisses ohne Bedenken als physiologisch resp. ethnologisch bezeichnet. In diesem Sinne konnte Virchow eine pathologische und physiologische Prognathie unterscheiden, welch letztere er bis zu einem gewissen Grade als ethnologisches Merkmal zulässt.

Die von Topinard aufgestellten Arten der Prognathie finden in vielfacher Beziehung Berücksichtigung im modernen Maasssystem der deutschen Anthropologen; es ist jedoch gleich zu bemerken, dass die deutsche Schule nicht den durch den Alveolarfortsatz gebildeten Prognathismus als den für ethnologische Zwecke in Betracht kommenden ansieht, sondern hierfür den "Mittelgesichtsprognathismus," den sie als den "wahren" bezeich-

net und bei dem der ganze Kiefer vorgestellt ist, heranzieht, und sich damit ganz in gegensatz bringt zu der Auffassung Topinards.

Dieser Ueberblick genügt bereits, um zu zeigen, in welchem Maasse sich die Ansichten über das Wesen des Prognathismus unter den Anthropologen im Laufe der Zeit geändert haben.

Besonders auffallend ist die verschiedene Beurteilung der alveolären und dentalen Prognathie bezüglich ihres Wertes für ethnologische Untersuchungen.

Während es einerseits als feststehende Thatsache betrachtet wird, dass derjenige Prognathismus, der durch die Schräge Stellung der Zahnfächer erzeugt wird, sich auf ganz unwesentliche Wachstumsrichtungen begründet, die auf die Formation und Stellung des übrigen Gesichtes nicht einwirken, vertritt man andererseits die Ansicht, dass ausschliesslich der Prognathismus der Region Alvelor-Subnasalpunkt für ethnologische Zwecke in Betracht kommt.

Durchweg wenig Beachtung hat das gegenseitige Verhältnis der Kiefer und Zähne gefunden, wenigstens ist die Ausbildung und Gestaltung der Kiefer sowie ihre Lage im Gesichte nicht in genügende Beziehung gebracht zu der Funktion des Gebisses und es ist nicht versucht worden, auf dieser mehr natürlichen Grundlage die verschiedenen Formen der Prognathie zu erklären.

Auch ausserhalb der anthropologischen Litteratur finden wir das Thema in dieser Richtung wenig bearbeitet.

Wie schon erwähnt, beziehen sich die Angeben über den Prognathismus in der zahnärztlichen Litteratur fast regelmässig auf das Verhältnis der beiden Zahnreihen zu einander; gelegentlich wird auch die Form des Kieferbogens mit in die Betrachtung hineingezogen, wie z. B. von Linderer* der näher ausführt, dass das Vorstehen der Kiefer je nach der Form des Zahnbogens verschiedener Art sein kann.

Er unterscheidet ein "Hervorragen" der Kiefer mit unregelmässigem und mit regelmässigem Zahnbogen. Die erstere Form kann nur den Oberkiefer betreffen. "Der vordere Bogen des Kiefers," sagt Linderer, "steht etwas vor und ist schmal, so dass er nur für die Zwei mittleren Schneidezähne Platz hat, von hier geht er schon schräg nach den Backenzähnen hin und es fehlt der gewöhnliche Winkel, der bei den Augenzähnen stattfindet, wodurch der Bogen des Kiefers nicht die gewöhnliche Wölbung erhält. Bei dieser Gestalt des Kiefers liegt die Oberlippe vorn höher, man sieht die Zähne sehr, selbst bei geschlossenem Munde, und die Sprache ist zuweilen lispelnd."

Die zweite Form betrifft nach Linderer entweder einen oder beide Kiefer. Die Zahnfortsätze bilden zwar den gewöhnlichen Bogen, sind aber sehr schräg nach auswärts gerichtet, wodurch die Zähne eine gleiche Richtung erhalten. Ragt der Oberkiefer in diesem Falle allein vor, so stehen beim Schliessen des Mundes die unteren Zähne, die eine regelmässige Stellung haben, weit hinter den oberen, er giebt an, dass diese Form in Stande ist die Funktion des Gebisses herabzusetzen, dass ferner diese "Bildung des Mundes" von dem "Negerkiefer" zu unterscheiden sei; Zähne und Zahnfortsatz des Oberkiefers ständen zwar auch sehr schräg nach auswärts am Negerschädel, der Unterschied würde aber doch augenscheinlich, wenn man den Kopf als Ganzes betrachtete.

* Linderer sen., Lehrbuch der Zahnheil kunde. Berlin. 1857. 148 ff.

Linderer bespricht sodann auch das Vorstehen beider Kiefer.

Ober- und Unterkiefer, sowie ihre Zähne sind schräg nach vorn gerichtet und berühren sich gegenseitig, wodurch die Funktion des Gebisses nicht gestört, wohl aber das Profil verunstalltet wird.

Auffallend ist, dass Linderer die Kieferbildung und Zahnstellung der Neger im Anschluss an das "Hervorragen des Oberkiefers mit regelmässigem Zahnbogen" bespricht, es liegt doch entschieden näher, die Formation des Negergebisses zu vergleichen mit dem "Hervortreten beider Kiefer mit regelmässigem Zahnbogen."

Auf alle Fälle jedoch ist er bemüht gewesen, "die Prognathismus" zu besprechen und zu differenziren, was wir nach Linderer bei Carabelli* der sich ebenfalls eingehend mit der Formation der Kiefer beschäftigte, auffallender Weise ganz vermissen.

Die von ihm vorgeschlagene und eingeführte Bezeichnung "Mordex prorsus" scheint alle Formen der Prognathie zu umfassen. Wenn Carabelli sagt, dass die vorstehenden Gebisse bei den Negern eine gewöhnliche Erscheinung sind, während sie bei der kaukasischen Rasse nur bei den Rhachitischen häufig gefunden werden, so geht schon daraus hervor, dass er die Linderer'sche Aufstellung unbeachtet lässt.

Er ist der Ansicht, dass in allen Fällen eine blosse Vorwärtsneigung des Alveolartheils, insbesondere des Os intermaxillare die Ursache seines "Mordex prorsus" sei und diese Auffassung führt ihn zur Vermischung teratologischer Zustände mit normal ethnologischen. Spätere Autoren waren nicht mehr in diesem Irrtum befangen, sie hatten nach eingehender Prüfung gefunden, dass ein Vorstehen der Kiefer aus verschiedenen Zuständen resultiren könne.

Ich erwähne besonders Magitot† der in eingehender Weise die Prognathismen bespricht und einen Prognathisme teratologique von einem Prognathisme ethnologique unterscheidet; beide bezeichnet er als "absolut," da sie sich auf beide Kiefer beziehen, gegenüber den "relativen" Prognathismen, die entweder nur den Oberkiefer oder den Unterkiefer betraffen und als Ante- und Retroversion in ihrer Form näher bestimmt sind.

Besonders Front gegen die Carabelli'sche Auffassung und Nomenklatur macht Iszlay‡ der es immer wieder betont, dass ein Hervortreten der Kiefer aus verschiedenen Zuständen resultirt. Nur die vollkommene Auseinanderhaltung der Ursachen könne zu einem befriedigenden Resultate bezüglich der Erklärung der einzelnen Formen führen.

Es sind nun vielfach Aufstellungen in diesem Sinne gemacht worden, man wird aber fast durchweg finden, dass die ursachlichen Momente nur sehr kurz behandelt oder auch nur angedeutet sind.

Auffallend ist es, dass die Kräfte, die mit der Bildung und Funktion des Gebisses zur Geltung kommen, in den wenigsten Fällen in directe Beziehung gebracht sind zur Formgestaltung des Gesichtes.

Soweit ich unterrichtet bin, ist es

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* Carabelli, G. Handbuch der Zahnheilkunde. Wien, 1844.

* Magitot, E. Traité des anomalies du système dentaire chez l'homme et les mammifères. Paris, 1877.

† Iszlay, Jos. Illustrative Skizzen zu Carabelli's "Mordex prorsus" und dessen Verhältnis zur sogenannten "Prognathia ethnologica" und Meyer's "Crania progenaea." Transactions of the International Medical Congress, 1881. Vol. III, p. 555 ff.

eigentlich nur Engel* der ausführlicher nachzuweisen sucht, dass die Form des Kiefergerüstes und somit die Linie des Profils durch die Bildung und Function der Zähne bedingt sei.

Er weist darauf hin, dass sich die Kiefer am allerwenigsten dem Einflusse der Muskeltätigkeit oder mechanischen Einwirkung von aussen entziehen könnten, da gerade auf sie verhältnismässig grosse Kräfte in häufiger Wiederholung und grösserer Beharrlichkeit einwirkten, als das bei einem anderer Knochen der Fall sei.

Engel wundert sich darüber, dass man diese Einflusse bei der Erklärung der Gesichts- und Schädelbildung bisher so wenig berücksichtigt habe. Stellung und Figur der Kiefer sei ein Ergebnis ihrer Verwendung und der Winkel, der "falschlich" als Gesichtswinkel bezeichnet würde, werde nur durch die Verwendung der Kiefer hervorgebracht. In dieser Ueberzeugung müsse man schon kommen, wenn man die Veränderungen am Ober- und Unterkiefer während der verschiedenen Lebensperioden genauer beobachtet habe.

Als von besonderer Bedeutung erwähne ich die Angabe Engels, dass durch den beim Kauen auf die Zähne ausgeübten Druck diese aus ihrer anfänglich verticalen Richtung mehr und mehr nach vorn abgelenkt würden und ihre Matrix, den Alveolartheil allmählich nach sich zögen.

Seine Untersuchungen über diesen Vorgang sind sehr exakt, er hat die Ablenkungen der Zähne eingehend begründet und mathematisch zu berechnen versucht. Interessant ist das Ergebnis, dass durchweg die oberen Zähne mehr unter der Wirkung des Kaudruckes stehen und infolge dessen eine stärkere Ablenkung zeigen als die unteren.

Beim Studium der Engel'schen Arbeit gewinnt man leicht den Eindruck, dass das Anhängigkeitsverhältnis der Kiefer und Zähne eine einseitige Behandlung erfahren hat, insofern als die Kiefergestalt und Lagerung nur von der Entwicklung und Function der Zähne abhängig gemacht ist, während das Gegenstück, dass nämlich bestimmte Kieferbildungen in besonderer Weise das Gebiss modificiren, wie es Betz* nachzuweisen versucht, wenig Berücksichtigung gefunden hat.

Im grossen Ganzen wird man aber den Aufstellungen Engels beipflichten müssen, auf alle Fälle, meine ich, dürfen sie nicht unbeachtet bleiben beim Studium der Prognathie.

Mir scheinen seine Ausführungen besonders im Gegensatz zu stehen zu der Ansicht derjenigen Anthropologen, die die Zähne und mit ihnen ihre Matrix, den Alveolartheil der Kiefer bei der Constatirung und Messung des Prognathismus als Rassenmerkmal gar nicht berücksichtigen. Es dürfte sich schon deswegen empfehlen, beide Auffassungen ausführlich in Beziehung zu einander zu bringen und die hierbei erzielten Resultate bei der Festsetzung und Unterscheidung der Verschiedenen Formen der Prognathie erfolgreich zu verwenden.

In diesem Sinne möchte ich meine Untersuchungen ausführen und zwar im Anschluss an das moderne deutsche Masssystem der Anthropologen. Ich wähle dieses, nicht weil ich annehme, dass es das einzig berechtigte ist und dass keine

* Engel. Der Einfluss der Zahnbildung auf das Kiefergerüst. Zeitschrift der k. k. Ges. der Aerzte. Wien. 1849.

* Betz, F. Physiologisch-pathologische Untersuchungen über Deformitäten der menschlichen Kiefer. Zeitschrift für rationelle Medicin. Bd. 11. Heidelberg. 1852.

Einwände dagegen gemacht werden können, sondern weil es uns am nächsten liegt und weil, wie ich glaube, kein anderes aufgestellt worden ist, das sich gleich allgemeiner Anerkennung erfreut hätte als dieses.

Die deutsche Schule misst den Profilwinkel bezogen auf die Horizontale, die die tiefste Stelle des Unterrandes der Augenhöhle mit dem senkrecht über der Mitte der Oeffnung des knöchernen Gehörganges liegenden Punkte verbindet.

Um den Profilwinkel zu bestimmen, zieht man von dem Mittelpunkt der Stirnnasennaht eine Gerade bis zum Mittelpunkte des Alveolarrandes, sieht also von den Zähnen ab. Man hat sich darüber verständigt dass die Orthognathie Winkel von 90-83, die Prognathie von 82° und darunter umfasst. Dieselben Stufen gelten auch bei der Messung des Alveolar- oder Zahnfortsatzwinkels, der von der Basis des Nasenstachels als oberen Punkte bis zum Mittelpunkte des Unterrandes des Zahnfortsatzes am Oberkiefer gemessen wird. Der Winkel zwischen dem oberen Ansatzpunkte des Profilwinkels an der Stirnnasennaht bis zum oberen Ansatzpunkte des Alveolarwinkels an der Basis des Nasenstachels bezeichnet den Grad der Mittelgesichtsneigung; auch für ihn gilt dieselbe Gliederung in die eben gegebenen Stufen, ebenso für die Stellung der Zähne für sich allein, die man am Alveolarrand bis zur Schneide misst.

Ich habe zu eingehender Besprechung und Vergleichung eine ganz orthognathe Form einem ausgesprochenen (ethnol.) Prognathismus an die Seite gestellt.

In diesem Sinne ist also der Prognathismus abhängig gemacht von drei Hauptmomenten.

1. von der Stellung des vorgeschobenen Kieferkörpers zum Schädelbasis.
2. von der Position des Alveolartheils.
3. von der Stellung der Zähne.

Gegen diese Aufstellung lässt sich durchaus nichts sagen, sie entspricht vollkommen den natürlichen Verhältnissen. Um aber den Wert der einzelnen in Betracht kommenden Momente und ihre Wirkung auf die Ausgestaltung des Profils richtig beurteilen zu können, ist es vor allen Dingen notwendig, die Frage der gegenseitigen Beeinflussung der drei Teile zu erörtern.

Sowohl die Beziehungen zwischen der dentalen und alveolaren Prognathie, wie auch ihr Verhältnis zur Prognathie des Mittelgesichtes verdienen eine besondere Beachtung.

Im engsten Zusammenhang damit steht die Lageveränderung des Subnasalpunktes, der für die Gradbestimmung der Alveolar wie der Mittelgesichtsprognathie von grundlegender Bedeutung ist. Die Erörterung der Frage, welche Momente eine Lagerveränderung dieses wichtigen Punktes herbeiführen können, ist entschieden von grosser Wichtigkeit, weil sie uns über das Abhängigkeitsverhältnis beider Prognathismen am besten aufzuklären imstande ist.

Es ist ferner eine Frage von Bedeutung, in wie weit der Nasofrontalpunkt in seiner Position durch eine Verschiebung des Subnasalpunktes und des Alveolartheils beeinflusst wird.

Bei der Messung der Winkel, die die verschiedenen Gesichtsabschnitte mit der Horizontalen bilden, zeigt sich für den Mittelgesichtswinkel auffallender Weise nur eine Differenz von 4°, für den Zahnwinkel von 15°, während der Alveolarwinkel des Negrotoschädels um 27 kleiner ist als der des Europaerschädels.

Es ist hier also zu constatiren, dass der hochgradige Prognathismus nicht aus einem Zusammenwirken aller drei Mo-

mente im Sinne der angegebenen Messung resultirt. Das ist schon deswegen zu betonen, weil man vielfach die Ansicht vertreten findet, dass hohe Grade der Prognathie durch gegenseitige Verstärkung der angeführten Momente bedingt werden.

Ich möchte hierzu bemerken, dass beispielsweise der Zahnwinkel, im eben beschriebenen Sinne gemessen, also festgelegt ohne Berücksichtigung der Wurzelrichtung, meiner Ansicht nach überhaupt nicht in ätiologisch wertvolle Beziehungen zum Alveolarwinkel zu bringen ist.

Dass ferner in sehr vielen Fällen ein geringer Dentalwinkel, einhergehend mit einem kleineren Alveolarwinkel, bei annähernd gradlinig verlaufenden Wurzeln einen grossen, in den meisten Fällen gut orthognathen Mittelgesichtswinkel bedingt.

Die Untersuchungen, die ich nun auf eine grössere Anzahl von Schädeln ausdehnte, ergaben ähnliche Resultate was mich veranlasste, etwas eingehender den Einfluss der Zähne auf das Kiefergerüst und die Ausbildung des Profils rücksichtlich der prognathen Formen zu verfolgen.

Die Annahme der Gestaltung der Kiefer auf Grund seiner durch die Zähne bedingten Function lässt mich meine Untersuchungen ausführen im Anschluss an die Theorie der functionellen Anpassung, wie sie hauptsächlich von Roux aufgestellt und durchgeführt ist. Sie gipfelt in der Annahme dass die functionelle Gestaltung eines Körpers das Resultat eines dauernden functionellen Reizes ist.

Bei den Knochen, auch bei den Kieferknochen, wird eine Ent- oder Belastung, entsprechend dem Zug oder Druck der die Function veranlassen den Teile auf die Elementarorgane einen trophischen Reiz ausüben, der bei gleichbleiben der Richtung des anregenden Moments eine graduelle Veränderung, eine Verstärkung resp. Vergrösserung der Matrix, bei wechselnder Richtung eine Modification der Gestaltung des Knochens bewirkt.

Diese ist nur dadurch zu erklären, dass an den Stellen, wo der Reiz fehlt, die Ernährung der Zelle eine zu mangelhafte ist, um gegen die auflösenden Elementarorgane im Knochen, die Osteoklasten, widerstandsfähig genug zu sein.

Im Anschluss hieran erwähne ich die vollständige Atrophie eines nicht in Anspruch genommenen Organes oder einer Gewebsparcelle.

Wir werden überall da, wo die Kräfte des anregenden functionellen Reizes am stärksten angreifen, eine forcirte Ernährung und dementsprechend eine besonders vorteilhafte Entwicklung haben, während in anderen, vielleicht benachbarten Districten, die durch eine veränderte Function aus dem Bereich des functionellen Reizes getreten sind, eine Antrophie sich geltend macht, die gegenüber der Activitätshypertrophie der beteiligten Teile erst recht auffällig wird.

Die Roux'schen Ausführungen gaben die Veranlassung zur Erweiterung der Auffassung der statischen Structur des Knochens, die in dem Sinne bestand, dass sie durch das Stehen des ganzen Individuums bedingt und dieser Position angemessen sei und daher hauptsächlich auch nur an den unteren Extremitäten und den Wirbelkörpern zur Ausbildung gelangt sei.

Heute müssen wir diesen Begriff weiter fassen, nachdem wir durch die Arbeiten Roux's wissen, dass ein Knochen oder Knochenaggregat in jeder irgend wie möglichen physiologischen Stellung dem auf dassebe ausgeübten Druck, ganz gleichgiltig, ob er von Knochen, Muskeln

oder Weichteilen ausgehend direct wirkt oder übertragen zur Geltung kommt, möglichst sicher zu begegnen sucht.

Bei dieser erweiterten Definition der Function, die zunächst keinen Unterschied macht zwischen Druck und Zug, ist also allen normalen, ausgebildeten Knochen, wenn auch in verschiedenem Maasse die Modulationsfähigkeit und den weitaus meisten eine Gestalt zuzusprechen, die bei Vermeidung jeglichen überflüssigen Materials den vorkommenden sie betreffenden Kräften genügend Widerstand zu bieten vermag.

Der Oberkiefer *per se* ist sowohl dem rein statischen Einflusse, wie auch der functionellen Gestaltung im Sinne Roux's wenig unterworfen.

Sein häufiger Contact mit dem beweglichen Unterkiefer jedoch, sein stetiges Zusammenarbeiten mit demselben sichert ihm eine Fülle functioneller Reize, denn für einen Knochen bedeutet es eine ausgesprochene Function, Druck ev. wechselnd mit Zug Widerstand zu leisten.

Die Brücke der Vermittlung bilden die Zähne, die in ihrer Stellung und Form selbst wieder massgebend sind für die Richtung des functionellen Reizes.

Anhaltspunkte für den Nachweis der Localisation desselben gewinnen wir in dem Verlaufe der Stärke und Dichtheit der die Substantia spongiosa zusammensetzenden Elementarteile, also der Knochenbälkchen, sowie der Dicke der im Bereiche des functionellen Reizes liegenden Compacta.

Wenn ich zunächst den Einfluss des vollkommen ausgebildeten Zahnes auf den Alveolartheil in Betracht ziehe, so thue ich das, um anfänglich einfache Verhältnisse zu schaffen.

Jedenfalls ist die Wirkung der verschiedenen Kraftrichtungen bestimmter und besser nachzuweisen, wenn fest steht, dass kein Teil der Kraft zu einer besonderen Modification der Wurzel verwandt wird.

Die von der Norm abweichenden Formgestaltungen und Verlaufsrichtungen der Wurzeln werden in einem späteren Abschnitte besprochen werden.

Aus der täglichen Erfahrung, aus der Praxis heraus ist der Beweis zu erbringen, dass auch im vollkommen fertig gebildeten Kiefer ein fortwährender functioneller Reiz in der Richtung seines Uebertragungsmittels, der Zähne, wirkt, der zwar in altgewohnter Weise fortgeführt in seiner Wirkung äusserlich nur schwer zu erkennen ist, aber sofort auch äusserlich wahrnehmbar wird, wenn man seine Richtungsmittel verschiebt.

Beweise genug hierfür liefert die zahnärztliche Orthopädie, die sich längst den functionellen Reiz zu Nutze gemacht hat, um eine Verbesserung gewisser Deformitäten des Gesichtes durch die Veränderung der Form und der Umrisse einzelner Gesichtknochen zu bewirken. Sie erreicht ihr Ziel durch Verlagerung des Richtungsmittels der Kraft mit Hilfe von besonderen, an den Zähnen befestigten Apparaten.

Ich, habe hier zu bemerken, dass die durch eine Veränderung der Stellung der Zähne erstrebte Regulirung gewisser Deformitäten anfänglich rein empirisch betrieben wurde; die auf diesem Wege gesammelten Erfahrungen führten jedoch ganz von selbst zu der erkenntnis, dass die Activitätshypertrophie und die damit zusammenhängende Formveränderung des Knochens hauptsächlich in der Richtung der Wurzelspitze erfolgt.

Diese Thatsache blieb natürlich nicht ohne Einfluss auf die Art der Construction der Regulirapparate, die ich in einem besonderen Abschnitte, in dem speciell die orthopädische Behandlung des Prog-

nathismus Berücksichtigung finden soll, besprechen werde.

Zwei treffliche bildliche Wiedergaben der Wirkung eines modernen Regulirapparates, wie er von Case, Chicago, angegeben ist, zeigen uns, dass der functionelle Reiz, der durch die Kaubewegungen des Unterkiefers im Oberkiefer erzeugt wird, in Folge der Verlagerung seiner Richtungsmittel-der Wurzeln der Frontzähne-eine nicht unbedeutende Formveränderung des vorderen Oberkiefers schafft.

Der erste Fall betrifft ein 13 jahriges Mädehen. Der obere Zahnbogen ist aussergewöhnlich klein im Gegensatz zu dem unteren, der ihn deshalb überragt.

Das Gesieht erseheint in Folge dieser Configuration der Kiefer lang sehmal und erkig, die Unterlippe springt vor, während die Oberlippe, wie überhaupt die ganze mittlere Partie des Gesiehtes eingedrüekt erseheint, der untere Teil der Nase ist dureh die Muskelansätze nach hinten gezogen.

Naeh sieben monatlieher Behandlung finden wir eine gänzliehe Umwandlung der natürlichen Züge dureh die Veränderung der Umrisse des vorderen Oberkiefers, vor allem aueh durch eine Verlagerung des Subnasalpunktes nach vorn.

Das Gegenstück liefert der zweite Fall. Er betrifft eine 20 Jahre alte Patientin, deren obere Frontzähne schräg nach innen gelagert (invertirt) sind, wodureh der Subnasalpunkt nack vorn gerückt wird. Die Folge ist ein unangenehmer Gesichtsausdruck, der sich besonders an der Oberlippe und der Form der Nase bemerkbar macht. Naeh der Behandlung liegen die Verhältnisse bedeutend günstiger, der Subnasalpunkt ist weit zurückgetreten entsprechend den jetzt schräg nach vorn gerichteten Zähnen und auf diese Weise ist ein angenehmer Gesichtsausdruck erzielt.

Nach dieser Ausführung könnte man annehmen, dass der durch die fertigen Wurzeln stetig in derselben Riehtung auf die Matrix ausgeübte Druck nur innerlich verstärkend auf die von ihm betroffene Kieferpartie wirkt; es ist aber zu bedenken, dass schliesslich die stärkere innere Struetur massgebend wird für die äussere Form, das also ein, lange Zeit in derselben Weise ausgeübter Druck, eine Vergrösserung der betroffenen Partie allerdings innerhalb der Riehtung der alten Dimensionen bedingt.

Die Erfahrung, die ieh bei meinen Untersuehungen von Sagittalschnitten besonders im Bereiche der mittleren Frontzähne des Oberkiefers gemaeht habe, lehrt, dass das zur Bildung, zur Festigung und Verstärkung des Alveolartheils herangezogene Material sieh vorzugsweise in der Fortsetzung der Achse der Zahnwurzel ablagert und zwar häufig genug bis über die Grenzen des Alveolartheils hinaus, sodass wir die Aetivitätshypertrophie bis in einer Entfernung von 2-3 em vom Ende der Zahnwurzel aus verfolgen können und zwar besser im Bereiche der Frontzähne, wo die Knoehenablagerung reichlieher zu erfolgen scheint, als im Bereiehe der Molaren.

Ich glaube das darauf zurüekführen zu müssen, dass diese Zähne zunäehst wegen ihrer festeren Einkeilung weniger befähigt sind, die für die Entwicklung des funetionellen Reizes erforderliche Erschütterung und Spannung innerhalb des Alveolarfortsatzes zu verursachen.

Zweitens ist zu bedenken, dass die Kronen der Molaren nur bei der Kaubewegung als Angriffspunkte der Kraft in Betracht kommen, die zweifelsohne als eine rotirende, als eine sich mehr gleichmässig über den Zahn verteilende Er-

schütterung wirkt, wenn auch nicht zu leugnen ist dass sie einen verhältnismässig grossen Teil ihrer Energie buccalwärts richtet.

Dem entsprechend Zweckmässig sind meiner Ansicht nach auch die Wurzeln gelagert, von denen zwei bestimmt sind, den nach aussen gerichteten Druck aufzufangen und zur Verteilung zu bringen.

Dann ist ferner darauf aufmerksam zu machen, dass die relativ geringe Länge der Krone zur Wurzel dem Zahn die Garantie möglichster Festigkeit bietet.

Ganz anders liegen die Verhältnisse bei den Frontzähnen und kleinen Backenzähnen, die sowohl durch die Beisswie durch die Kaubewegung in Anspruch genommen werden, die ferner bezüglich des Längenverhältnisses der Krone zur Wurzel schlechter wegkommen als die Molaren.

Gleichzeitig ist zu beachten, dass beim Abreissen resp. Abbeissen der Nahrungsmittel die Schneide- und Eckzähne nicht nur einem in der Achse des Zahnes oder doch annähernd mit ihr parallel verlaufendem Drucke ausgesetzt sind, sondern auch einem Zuge, der haputsächlich in horizontaler Richtung wirkt. Nun kommt dazu, dass für die Frontzähne die Kaubewegung nicht mehr wie bei den Molaren, als rotirende, sondern als einseitig nach aussen resp. nach vorn und oben wirkende Kraft in Betracht kommt,- mit andern Worten- bezüglich der Frontzähne unterstützen sich vielfach die Kau- und Beissbewegungen in ihrer Kraftrichtung und Wirkung.

Bei Berücksichtigung dieser Thatsachen finden wir es verständlich dass die Wirkung des Functionellen Reizes im Bereiche der Frontzähne sowohl was innere Structur, wie aussere Form betrifft, besser zum Ausdruck kommt.

Bei der Durchsicht und Vergleichung von 30 Oberkieferphotogrammen habe ich den Eindruck gewonnen, dass diese Kraftlinien im Kieferkörper vicariirend auftreten, ich habe gefunden, dass beispielsweise die vordere auffallend stark entwickelt ist zu Ungunsten der hinteren, die dann kaum auffällt.

Ich nehme an, dass die verschieden starke Ausbildung der Compaktaspangen von der Lokalisation des Hauptkaudruckes dem oberen Gesichtsschädel gegenüber, wie auch von der Configuration des Zahnbogens und der Stellung der Zähne abhängig ist.

Die Formation des Zahnbogens im Sinne der Begrenzung des Kauflächencomplexes, die in den meisten Fällen leicht convex verlauft, kann entweder mehr verteilend oder auch concentrirend auf den Kaudruck wirken ferner die Position seiner Concentrationslager bestimmen.

Es ist leicht einzusehen, dass ein stark convexer Zahnbogen des Oberkiefers, dem ein concaver des Unterkiefers entspricht, auf seiner Höhe den Kaudrucke mehr ausgesetzt ist, als ein annähernd geradlinig verlaufender Zahnbogen in seinen einzelnen Teilen, zumal da die abfallenden resp. aufsteigenden Leitenstücke schiefe Ebenen für ihn bilden, die die Nahrungsmittel immer wieder der Höhe resp. der Tiefe des Bogens als dem Hauptconcentrationslager des Kaudruckes zuführen.

Mit der Verschiebung der Höhe des Zahnbogens geht naturgemäss auch das Maximum des Kaudruckes. Liegt dieses relativ weit nach vorn, so wird besonders der vordere Teil des Kiefers und mit ihm der Stirnfortsatz belastet, liegt er weiter rückwärts, so werden wir die hintere Stützleiste besser ausgeprägt sehen.

Es kommt nun aber nicht allein die Verschiebung der Höhe des Kauflächen-

complexes innerhalb des Zahnbogens in Betracht, sondern auch die Lagerung des gesamten Kiefers nach vorn oder hinten, die sowohl durch Vererbung, durch die besondere Art und Ausdehnung seiner Benutzung, wie auch durch pathologische Verhältnisse bedingt sein kann.

Auch auf diese Weise kann die Hauptbelastung bald mehr nach vorn, bald mehr nach rückwärts fallen.

Schliesslich ist meiner Ansicht nach die Stellung der Frontzähne von Einfluss auf die Ausbildung besonders der vorderen Kraftlinie des Molarenteils, insofern nämlich, als die keilförmigen Trajectorien ihrer Wurzeln, falls diese ganz oder annähernd in der Ebene des Kiefers galagert sind, eine wirksame Gegenstütze für die vordere Druckleiste des Molarenteils liefern und die Compakta des Frontalfortsatzes entlasten, während stark schräg gerichtete Wurzeln mit ihren Kraftbahnen die vordere Druckleiste im unteren Teile und unter ungünstigem Winkel treffen und deswegen nicht aufrichtend und stützend wirken können.

Wenn auch das mir zur Verfügung stehende Material nicht unfangreich, auf alle Fälle nicht ausreichend für absolut sichere Schlussfolgerungen ist, so halte ich mich doch auf Grund dessen, was ich bei der Untersuchung dieser Stücke geschen und gesammelt habe, für berechtigt, die Ansicht zu vertreten, dass ein weit vorliegender Kiefer wie auch ein nach vorn gerücktes Concentrationslager des Kaudruckes einen starken vorderen Compactastrang bedingt, der um so kräftiger entwickelt ist, je schräger die Zahnwurzeln im Kiefer verlaufen, um so schwächer, je mehr die Zähne in die Richtungsebene des Kiefers fallen, dass umgekehrt das Zurücktreten des Gesamtkiefers, wie der Bisshöhe eine stärkere Ausbildung der hinteren Stütze verursacht.

Orthognathe Kiefer mit annähernd geradlinig verlaufendem Kauflächencomplex zeigen gewöhnlich eine gleichmässig starke Ausbildung beider Druckbahnen.

Ich habe diese Verhältnisse deswegen genauer untersucht und klargelegt, weil sie mir eine besonders grosse Bedeutung zu haben schienen für die Lagerung und Fixirung des Nasofrontalpunktes, der bei der Messung der Mittelgesichtsprognathie neben dem Subnasalpunkt die Hauptrolle spielt.

Es wäre ja sehr interessant, ihn bezüglich seiner Position von der durch den Kauakt bedingten functionellen Gestalt des Oberkiefers direct abhängig zu sehen, weil damit auch zugleich der Mittelgesichts prognathie im Sinne des deutschen anthropologischen Maasssystems der Boden entzogen würde und somit allenfalls die ganze Gesichtsbildung als das Resultat der bein Kauen zur Geltung kommenden Kräfte anzusehen wäre.

Wenn ich nun annehme, das eine stark ausgebildete und in Anspruch genommene, von den Trajectorien der Frontzähne nicht gestützte vordere Druckbahn durch Verschiebung des unteren Teiles der Compactaspange des Frontalfortsatzes ein Zurückweichen des Nasofrontalpunktes sowie der stirn bedingt, so hoffe ich, dass dieses nach den besprochenen Untersuchungen nicht allzu unwahrscheinlich klingt und wenigstens zu gründlicher Prüfung Aufnahme findet.

In ähnlicher Weise würde das Vortreten des Nasofrontalpunktes und der Stirn durch eine starke Inanspruchnahme der Compacta des Stirnfortsatzes durch die Trajectorien der in der Ebene des Kiefers verlaufenden Vorderzähne

bei gleichzeitig fehlen der vorderer Mahlzahndruckbahn zu erklären sein.

Im Anschluss hieran will ich die Formgestaltung des Alevolartheils innerhalb engerer Grenzen im Sinne der Roux'schen Theorie kurz besprechen.

Angenommen, dass Ausbildung und Localisation des functionellen Reizes im Alveolartheil von der Stellung der Zähne, speciell von der Richtung der Wurzeln abhängig ist, so bleibt für uns noch zu untersuchen in welcher weise, vor allen Dingen auch in welcher Richtung die während des Kauaktes zur Geltung kommenden Kräfte auf die Zahn-resp. Wurzelachse einwirken, wenn wir mit einiger Bestimtheit die Formation des Alveolartheils selbst in seinen Feinheiten als das Resultat der Function erkennen wollen.

Da, wie oben ausgeführt ist, die Kraftwirkungen besser im Bereiche der Frontzähne nachweisbar sind, so habe ich diese nebst ihrer Matrix für meine Untersuchung harangezogen.

Sollen die Kräfte berücksichtigt werden, die auf die Zähne einwirken, so sind ausser den Bewegungen des Unterkiefers, auch der Zungendruck einerseits, der Lippen- und Waugendruck andererseits mit in Rechnung zu ziehen.

De diese Einflüsse aber schon bei normaler Thätigkeit der Kauorgane fast ganz in Wegfall geraten und nur für die Einstellung der Zähne während des Durchbruches und solonge sie an der Articulation der Kiefer unbeteiligt sind, in Betracht kommen, kann ich mich beschränken auf das Studium der durch die Bewegungen des Unterkiefers zur Geltung kommenden Kräfte.

Für die Beurteilung der functionellen Gestalt des Alveolartheils im Bereiche der Frontzähne sind alle den Kauakt zusammensetzenden Bewegungen, das Abreissen, das Abbeissen und Zermalmen der Speisen bezüglich ihrer Druckwirkung zu berücksichtigen.

Das Abbeissen ist eine combinirte Bewegung, die den Zahn einem Drucke nach verschieden Richtungen aussetzt.

Im ersten Momente schiebt sich der gesenkte Unterkiefer soweit vor, dass die Schneiden seiner Zähne mit denen der oberen in einer Ebene liegen.

Da bereits in dieser Stellung ein grosser Teil der Kaumuskelkraft in Anwendung kommt, so haben wir in Anfange der Abbeissbewegung einen Druck in der Richtung der langen Achse des Zahnes.

Dadurch, dass nun der Unterkiefer im zweiten Teil der Bewegung zurückgleitet, bildet der aufzunehmende Bissen eine schiefe Ebene, wodurch ein Druck sowohl in vertikaler, wie auch in horizontaler Richtung nach vorn resp. aussen erzeugt wird. Die Resultirende aus den beiden Druckcomponenten wird die Zahnachse unter spitzem Winkel schneiden.

Aehnlich verhält es sich mit der Abreissbewegung, nur dass hier der in horizontaler Richtung nach vorn wirkende Zug dem gleichzeitig verticalwärts ausgeübten Druck ganz bedeutend überlegen ist, so dass die Resultirende die lange Achse des Zahnes unter einem grösseren Winkel schneidet.

Die Mahlbewegung kann wegen der meissel-oder keilförmigen Form der Kronen der Frontzähne die ihr nach vorn hin zu Gebote stehende Kraft nicht ganz zur Anwendung bringen. Ein Teil derselben wirkt senkrecht auf die Fläche des Keils als horizontale den Zahn nach vorn drängende Stosskraft, der andere verläuft aber parallel mit der hinteren Fläche des Keils, findet also keinen Widerstand und bleibt dementsprechend ohne Druckwirkung.

Diese Betrachtungen lehren dass die

Hauptdruckwirkung nicht in der Fortsetzung der langen Achse des Zahnes erfolgt, sondern in einer Richtung, die mit der Zahnachse einen mehr oder minder spitzen Winkel bildet.

Es bedarf wohl kaum eines besonderen Hinweises, dass neben der Stellung der Zähne im Kiefer auch das Lagerungsverhältnis der Krone zur Wurzel in jedem einzelnen Falle bei der Beurteilung der Grösse und Richtung des Reizes in Betracht zu ziehen ist.

Liegen die Frontzähne mit ihren Achsen in der Ebene des Kieferkörpers, so bilden Zahnfortsatz und Kieferkörper annähernd dieselbe Ebene; dadurch dass die Knochenablagerung teils in der Richtung der Zahnachse erfolgt, teils in einer zu dieser stark spitzwinkligen Richtung, wird der Kieferkörper verhältnissmässig länger (höher) als dick. Speciell im Sinne der Oberkieferentwickelung kann ich sagen: Je beträchlicher die Ablenkung der Frontzähne, um so mehr fällt die Wirkung der Activitätshypertrophie in die Ebene des harten Gaumens, der in solchen Fällen nur leicht nach vorn abgedacht in die vordere Fläche des Oberkiefers übergeht.

Bei massiger oder überhaupt nicht vorhandener Zahnablenkung dagegen erfolgt die Knochenablagerung in einer auf dem harten Gaumen mehr oder weniger senkrechten Richtung, so dass sich am vorderen Ende des Oberkiefers ein bis zu 10 mm. hoher Knochenwall, der natürlich annähernd in der Richtung der Zahnachse liegt, aufbaut.

Diese Vorgänge haben für die Lagerung des Subnasalpunktes eine grosse Bedeutung; er wird sich bei jeder Veränderung der Richtungsebene der Frontzähne nicht unbedeutend verschieben, und im Sinne meiner Besprechung mache ich darauf aufmerksam, dass er durch in ihrer ganzen Länge schräg gerichtete Zähne nach rückwärts verlegt wird, woraus eine Vergrösserung des Mittelgesichtswinkels resultirt, während orthognath gerichtete Zähne entgegengesetzt wirken.

Für die Nasenbildung und die Höhe des Gesichtes bleibt die Verschiebung des Subnasalpunktes nicht ohne Einfluss, denn bei fehlendem Knochenwall-was einer Verlagerung des Subnasalpunktes nach rückwärts entspricht-wird der untere Ansatz der Nase tiefer zu liegen kommen als die Nasenspitze, was zur Folge hat, dass die Nase aufgestulpt erscheint. Eine sehr starke Ausbildung des Knochenwalles verursacht eine mehr hängende Nase.

Um nichts ausser Acht zu lassen, was eine Differenzirung prognather Formen erleichtern könnte, erwähne ich, dass die Gestaltung des harten Gaumens zum grossen Teil abhängig ist von der Richtungsebene der Frontzähne. Er wird flach sein und die Mundhöhle verkleinern bei schrägem Verlauf der Zahnachsen, er wird hochgewölbt sein und die Mundhöhle vergrössern, wenn Zähne und Kieferkörper in einer Ebene liegen.

Tritt aber während der Entwicklung und vor Abschluss des Wurzelwachstums beconders der bleibenden Zähne eine dauernde Verschiebung der Kraftrichtungen, die nach längerem Bestehen bereits im Verlaufe und der Anordnung der Spongiosa fixirt sind, ein, so wird sich nicht allein die den Zahn umlagernde Knochensubstanz dieser neuen Beanspruchung anpassen, sondern auch die Wurzel des Zahnes selbst.

Vor dem Durchbruch wird der Zahn möglichst in der Richtung der durch functionelle Anpassung in ihrer Lagerung bestimmten Spongiosa auf dem Wege des geringsten Widerstandes sich der

Oberfläche nähern. Ein ihn vom Wege ablenkendes Hindernis bedeutet schon eine Verschiebung der Druckrichtung das Resultat ist eine Krümmung der Wurzel.

Nach dem Durchbruche ist der Zahn, dessen Wurzel auch jetzt noch nicht ausgebildet ist, sofort nicht unbedeutenden Kraftwirkungen ausgesetzt, die ihn von seiner bisherigen Richtung ablenken und eine Wurzelform bedingen, die mir, falls sie gleichartig an allen Frontzähnen ausgebildet ist, als ein nicht zu unterschätzendes Differenzirungsmittel bei der Vergleichung prognather Formen erscheint.

Kurz nach dem Durchbruche bilden die Frontzähne bei gesicherter Seitenartikulation Angriffspunkte der durch die Function der Zunge und durch die Spannung der Lippen und Wangen erzeugten Kräfte.

Besonders die Lippe wirkt wie eine Schiene, durch die die Zähne zurückgehalten oder auch zurückgerängt werden.

Dieser Lippendruck wird besonders stark einwirken auf die bleibenden Frontzähne, die bei noch persistirenden Milchzahnkronen über diesen zum Durchbruch gelangen. Fallen die Milchzahnreste, so geben die Kronen der bleibenden Zähne dem stetig wirkenden Lippendruck leicht nach, da sich ihnen kein Hindernis von Bedeutung entgegenstellt, bis sie berührt werden von den schon mehr in ihrer Stellung fixirten Schneidezähnen des Unterkiefers.

Diese nicht plötzliche, sondern mehr allmähliche Ablenkung der Zahnkrone nach innen verrät sich durch eine mehr oder minder concav nach innen gekrümmte Zahnwurzel.

In ähnlicher Weise werden alle Zähne durch den Lippendruck beeinflusst, die bei gesicherter Seitenarticulation sehr schräg nach vorn durchbrechen.

Diese mehr horizontale, nicht durch abnorme Zustände verursachte Lagerung der in ihrer Wurzel noch nicht ausgebildeten Zähne kann einer vererbten Anlage entsprechen, ist aber wohl in der Hauptsache abhängig von einer ausgiebigen Benutzung des Milchzahngebisses.

Je kräftiger die Beiss- und Kaubewegungen ausgeführt werden, je häufiger ein horizontaler Druck oder Zug auf die Milchzähne einwirkt, um so stärker werden sich die Druckbahnen über ihnen ausbilden und um so schräger werden die Trajectorien der Spongiosa verlaufen.

Dieser Beanspruchung des Knochens werden aber die in Entwicklung begriffenen Zähne nach Möglichkeit folgen.

Die vererbte Anlage kann daher durch eine intensive Function gestört und im Sinne der neuen Beanspruchung des Kauorgans modifizirt werden.

Dadurch, dass unter gleichförmigen Lebensbedingungen und unter gleichbleibender Ernährungsweise mit der Zeit die Anlage möglichst so erfolgt, dass sie der später einsetzenden Function entgegen kommt und diese zu ausgesprochener Formenbildung unterstützt, müssen sich für ganze Gruppen von Menschen typische Merkmale und besondere Kieferformen entwickeln.

Auch für die Entwicklung und Stellung der Milchzähne kommt neben der vererbten Anlage die Function der Nahrungsaufnahme in Betracht.

Die mehr oder minder intensive Ausführung des Sauggeschäftes wird aber nicht genügen, individuell verschiedene Formen auszubilden. Beim Säugling haben wir eben immer dieselbe Nahrung und immer dieselben Bewegungen bei ihrer Aufnahme.

Erst die Verarbeitung fester Nahrungsmittel ermöglicht dem Kinde einen freien und willkürlich ausgedehnten Ge-

brauch seines Gebisses, dessen mehr oder minder starke Inanspruchnahme aber weniger die eigene Gestaltung als vielmehr die Entwicklung und Ausbildung des bleibenden Gebisses beeinflusst.

So ist die Schräglagerung der bleibenden Frontzähne und die dadurch bedingte Wurzelkrümmung nicht nur das Resultat eines unregelmässigen Zahnwechsels oder die Folge sonstiger abnormer Zustände, sondern auch das Ergebnis einer intensiven normalen Function des Milchzahngebisses bei regelmässigem Zahnwechsel.

Ich darf nicht unerwähnt lassen, dass bei schräggelagerten und vorstehenden Zähnen häufig concav nach aussen gekrümmte Zahnwurzeln anzutreffen sind. Für diese Bildung sind ebenfalls mechanische Ursachen geltend zu machen, die auf die bleibenden Zähne bald nach ihrem Durchbruch einwirken.

Vor allen Dingen wird das Fehlen der Seitenzähne und das dadurch bedingte frühzeitige Zusammentreffen der Vorderkiefer eine Verschiebung der Kronenrichtung der oberen Frontzähne nach aussen und in Folge dessen eine Krümmung der Wurzel veranlassen.

Ich bringe hiermit die im Anschluss an die Vergleichung der orthognathen mit der prognathen Form ausgeführten Untersuchungen über den Einfluss der Zähne und ihrer Function auf die Gestaltung des Kiefers, die meiner Ansicht nach das Studium der Prognathie bedeutend erleichtern, zum Abschluss, indem ich gleichzeitig zu bedenken gebe, dass die in diesem Abschnitte gemachten Beobachtungen uns nicht dazu bestimmen dürfen, alle und jede Gestalt des Kiefers auf die Zahnbildung und Kaufunction zurückzuführen unter der Begründung, dass Form und Richtung der Knochen durch die Form und Grösse der von ihnen eingeschlossenen Organe durch Mitwirkung der sie in Function setzenden Muskelkräfte und durch andere äussere Einflüsse bedingt werden.

Wir müssen häufig genug das Gegenteil erfahren, dass nämlich hereditär unnormal gebildete Kiefer die Gestaltung des Zagnbogens vollkommen beherrschen.

Ist jedoch das Vorstehen des Alveolartheils und der Zähne congenitalen Ursprungs, so ist der Kiefer meist in der Gegend der Praemolaren so zusammengedrückt, dass die Mittleren Schneidezähne nicht nebeneinander, sondern in einem Winkel zueinander stehen bei gleichzeitig vorhandener hoher, vielfach unnormaler Gaumenwölbung.

Das bei der Beurteilung prognather Formen die Beobachtung nicht auf den Oberkiefer und die von ihm beherrschten Teile beschränkt bleiben darf, sondern dass auch der Unterkiefer in seiner Form sowohl wie in seiner Lagerung zum Oberkiefer volle Berücksichtigung finden muss, ist selbstverständlich.

Abgesehen von ganz wenigen Ausnahmen können wir in jedem einzelnen Falle erst dann eine sichere Entscheidung treffen, ob eine Formationsanomalie im Sinne des Prognathismus vorliegt oder nicht, wenn wir das Verhältnis beider Kiefer zu einander untersucht haben.

Ich möchte diesen Teil meiner Abhandlung nicht beschliessen, ohne ausdrücklich zu bemerken, dass eine functionelle Gestaltung des Oberkiefers, die ihren Einfluss auch auf benachbarte Knochen ausdehnt und die Bildung des Profils zum grossen Teil beherrscht, nicht von der Hand zu weisen ist und dass sie viele Momente bietet, die für die Erkennung und Auseinanderhaltung der einzelnen Formen der Prognathie äusserst wichtig, wenn nicht unentbehrlich sind.

Im Anschluss an diese einleitenden

Untersuchungen und unter sorgfältiger Berücksichtigung ihrer Ergebnisse, will ich nunmehr versuchen, die Prognathismen zu differenziren, indem ich für jede einzelne Form charakteristische Merkmale festlege, die nach möglichkeit zu ihrer Aetiologie in Beziehung gebracht werden sollen.

Wir haben gesehen, dass das Profil in seiner Gestaltung wenigstens bis zum Nasofrontalpunkt unter dem Einfluss der funktionellen Gestaltung des Oberkiefers steht, wir haben nachgewiesen, dass Zähne und Alveolarfortsatz in Form und Lagerung vollkommen von einander abhängen, dass insbesondere der Subnasalpunkt durch die Einstellung der Zähne und ihre Funktion in seiner Lage bestimmt wird. Bei Berücksichtigung dieser Thatsachen erscheint es mir verfehlt, die Arten der Prognathie von dem Lagerungsverhältnis einzelner Abschnitte des Gesichtsprofils zu einer fixen Linie abhängig zu machen.

Wenn der Prognathismus eine Einteilung in einen Mittelgesichts, alveolären und dentalen Prognathismus erfährt, so ist allerdings von vornherein nichts dagegen einzuwenden, es kann vielmehr im Interesse der Übersichtlichkeit geboten erscheinen.

So lange aber die einzelnen Begriffe nicht abhängig von einander gemacht werden, so lange nicht ihr gegenseitiges Verhältnis das Ausschlaggebende ist, so lange wird diese Einteilung, die besonders anthropologischerseits durchgeführt ist, nicht die Grundlage abgehen können für eine natürliche ätiologisch begründete Differenzirung der Prognathismen. Das geschieht bisher nicht, ist vielfach sogar ängstlich vermieden.

Wie anders ist es beispielsweise zu deuten, wenn die deutschen Anthropologen den Mittelgesichtsprognathismus, der doch in der Profillinie durch zwei in ihrer Lage von der Funktion und Ausbildung des Gebisses abhängige punkte, durch den Subnasal- und Nasofrontalpunkt, begrenzt ist, als den wahren und einzig für ethnologische Zwecke in Betracht kommenden von dem alveolären und dentalen Prognathismus absondern, weil er nicht wie die letzteren auf ganz unwesentliche, vielfach sekundär sich entwickelnde Wachstumsrichtungen zurückzuführen ist.

Meiner Ansicht nach verdient das Verhältnis der Kronenrichtung zum Wurzelverlauf und zum Subnasalpunkt dieselbe Berücksichtigung, wie dessen Verhältnis zum Nasofrontalpunkt. Alle Teile sind möglichst in Beziehung zu einander zu bringen, da sie nachgewiesenermassen von einander abhängig sind. Indem sind Verhältniszahlen in diesem Fall besser als absolute Angaben.

Allgemein gehalten und mehr indifferent hat eine Auffassung, die in der Aufstellung einer pathologischen und einer physiologischen Form der Prognathie begründet ist, in der zahnärztlichen wie in der anthropologischen Literatur gleich gute Aufnahme gefunden.

Die Annahme einer physiologischen und einer pathologischen Form als Basis für ein natürliches Einteilungssystem ist entschieden berechtigt, wenn sie ihre Begrundung erfährt in der Erkenntnis, dass die physiologische Form vielmehr Verhältnissen entspricht, die man gewohnt ist als normale zu bezeichnen, als die pathologische, das sie ferner in jeder Phase ihrer Entwicklung im erklärlichen und zweckmässigen Verhältnis steht zu ihrer Funktion.

Eine pathologische Bildung dagegen wird als das Resultat irgend welcher Entwicklungsstörung und abnormer Wachstumsverhältnisse von vornherein

der ihr zugedachten Funktion weniger entsprechen. Sie ist in Folge dieses Missverhältnisses vielfach unbeständig, neigt zu Excessen und wird störend für das Individuum.

So übersichtlich und abgrenzend diese Auffassung scheint, es wird doch, wie wir sehen werden, manchmal nötig, aus dem Rahmen derselben herauszutreten, um manche Formen richtig zu beurteilen. Denn einerseits finden sich Fälle von Prognathie, die nachweisbar durch unnormale Wachstumsverhältnisse bedingt, als fertige Formen eine constante, der physiologischen Prognathie sich nähernde Bildung repräsentiren und dauernd ihre Funktion zweckmässig verrichten. Trotzdem sind diese Formen ihrer Aetiologie nach als pathologische aufzufassen.

Andererseits können wir beobachten, dass bei ganz proportionirten anatomischen Verhältnissen, auch der Kiefer zu einander, sich eine Prognathie des Oberkiefers entwickelt, die progressiv ist und schliesslich für das Individuum störend wird.

Als Grundlage für die Aufstellung verschiedener Formen wähle ich das Verhältnis einzelner Abschnitte des Profils zu einander. Unterstützende und aufklärende Momente finde ich in der Gestalt der Zähne per se, in der Form des Gaumens und vor allem auch in dem Articulationverhältnis der oberen Zahnreihe zur unteren.

Die für mich in Betracht kommende Profillinie ist nach oben begrenzt durch den Nasofrontalpunkt, nach unten durch die Schneidekante der Frontzähne, die einzelnen Abschnitte innerhalb dieser Linie sind angegeben durch den Subnasalpunkt und den die mittleren Schneidezähne begrenzenden Alveolarrand. Die Lage dieser Punkte zu einander bezieht sich auf eine Gerade, die senkrecht zur deutschen Horizontalen verläuft und den unteren Augenrand da trifft, wo der Oberkiefer mit dem Jochbein zusammenstösst.

Die Richtungslinien der einzelnen Abschnitte sind gleichzeitig in Winkelbeziehungen zur Horizontalen zu bringen.

In diesem Sinne lassen sich die verschiedenen Bildungen des Profils schematisch scharf charakterisiren.

Prognathe Formen, mögen sie nun das Resultat pathologischer und anormaler Wachstumsverhältnisse oder die Folge einer intensiven, uneingeschränkten Funktion des Gebisses sein, sind entweder auf die Dauer constant oder erreichen mit der Zeit so hohe Grade ihrer Bildung, dass sie die Funktion des Gebisses bedeutend herabsetzen; ich stelle sie als progressive Formen den constanten gegenüber.

Eine Differenzirung in diesem Sinne scheint mir hinsichtlich der Prophylaxe und der orthopädischen Behandlung der Prognathie ebenso wichtig, wie eine Auseinanderhaltung der physiologischen und pathologischen Formen. Niemals natürlich ist constant und progressiv gleich zu setzen mit physiologisch und pathologisch. Man kann nur mit Recht von constanten und progressiven physiologischen und pathologischen Prognathismen sprechen. Hinsichtlich der physiologischen Prognathie wähle ich aber die Begriffe constant und progressiv als Grundlage einer durchgehenden Differenzirung.

Die constante physiologische Prognathie ist eine Eigenthümlichkeit der schwarzen und gelben Rasse, ich will damit nicht sagen, dass sie hier durchweg die Regel ist, es kommen überall Ausnahmen vor, es giebt einerseits Neger, die ebensowenig prognath sind, wie die Weissen, andererseits finden sich Weisse, die

einen ausgesprochen physiologischen Prognathismus aufweisen.

Atavismus und Rassenmischung spielen auch hier eine grosse Rolle.

Der constante physiologische Prognathismus ist eine Form für sich abgeschlossen und durch ganz bestimmte Verhältnisse zu unterscheiden von anderen prognathen Bildungen, er entspricht dem physiologischen resp. ethnologischen Prognathismus anderer Autoren.

Beim constanten physiologischen Prognathismus ist die Artikulation im Bereiche des ganzen Zahnbogens eine geschlossene, die Art des Zusammentreffens ist aber nicht, wie vielfach angegeben, dieselbe wie bie der Orthognathie dentalis. Ich finde beispielsweise bei Sternfeld (Anomalien der Zähne) Scheff, Handbuch der Zahnheilkunde p. 443 angegeben, dass bei dem physiologischen (ethnologischen) Prognathismus das Verhältnis der oberen Zahnreihe zur unteren dasselbe ist, wie beim sogenannten regelmässigen Gebiss.

Das möchte ich eben nicht unterschreiben, denn zunächst treffen die Zähne, insbesondere die Frontzähne unter einem viel kleineren Winkel aufeinander, sodann bringt es die breite und flache Bildung der Höcker der Seitenzähne, wie auch die gewöhnlich stark ausgeprägte Wölbung des oberen Zahnbogens mit sich, dass die obere Zahnreihe die untere nicht in dem Maasse übergreift, wie beim regelmässigen Gebiss.

Man gewinnt leicht den Eindruck, als seien die oberen Zähne den unteren mehr aufgelagert.

Diese Verhältnisse ermöglichen eine ausgiebige Seitenbewegung des Unterkiefers, wie sie besonders dem Pflanzenfresser von Vorteil ist.

Uebergreifende oder Frontzähne und hohe Höcker der Seitenzähne sind eine Eigentümlichkeit des modernen orthognathen oder auch pathologisch prognathen Gebisses, dem die Verarbeitung roher, insbesondere vegetabilischer Nahrung niemals ernstlich zugemutet wurde.

Bei stärkeren Seitenbewegungen des Unterkiefers empfinden wir es leicht, dass uns die oberen Frontzähne im Wege sind.

Hätten wir ausser den Zähnen keine besonderen Zerkleinerungsinstrumente und wären genötigt, nur Nahrungsmittel zu verarbeiten, so würden energische und ausgiebige Mahlbewegungen des Unterkiefers ohne Zweifel die oberen Frontzähne nach oben aus dem Wege gelagert haben.

Sollten nicht die weit ausholenden Mahlbewegungen den Wiederkäuern den Besitz der oberen Frontzähne verbieten?

Ich bin nicht abgeneigt, bestimmte willkürliche Verunstaltungen des Gebisses einzelner Völker mit der Ernährungsweise in einen unmittelbaren Zusamenhang zu bringen.

Manche Stämme des Sambesigebietes, ich nenne besonders die Batoka und die Dinka, pflegen den jungen Leuten beim Eintritt in die Pubertät die oberen vier Schneidezähne auszubrechen, was Schweinfurth* als eine Nachahmung der vergötterten Wiederkäuer ansicht.

Nun steht fest, dass diese Stämme, obgleich sie die grössten Viehzüchter sind und ihre Herden in guten zeiten zu riesiger Zahl anwachsen, doch fast kein Fleisch essen; ausser Milch nähren sie sich nur von Vegetabilien, insbesondere von Amylaceen.

Es ist nun eine äusserst interessante Erscheinung, dass in dem veränderten Batakagebiss nicht nur der zahnlose

* Im Herzen von Afrika. Leipzig, 1874, p. 163.

Oberkiefer der Wiederkäuer eine Nachahmung findet, sondern meiner Ansicht nach auch Mahlbewegungen, die denen der Wiederkäuer ähnlich sind, entstehen: denn die Entfernung der oberen Schneidezähne im zehnten oder zwölften Jahre wird ausser der freien Beweglichkeit des Unterkiefers zur Folge haben, dass der Knocherne Oberkiefer sich zurückzieht, während der Unterkiefer sich weiter zu entwickeln fortfährt.

In solchen Fällen folgt allmählich eine Vorragung des Unterkiefers und die Zähne artikuliren dann mehr an ihren Schneidekannten und den Spitzen ihrer Höcker.

Bei solcher Artikulation nimmt die betreffende Person die Gewohnheit an, den Unterkiefer mittelst der Flügelmuskeln im Kreise zu bewegen. Die sich gegenüberstehenden Zähne nutzen sich dann gegenseitig in solchem Grade ab, dass in nicht allzulanger Zeit die Höcker verschwinden, wodurch eine Nachahmung der Mahlbewegungen der Wiederkäuer noch besser ermöglicht wird.

In ähnlicher Weise sind bei jedem physiologisch-prognathen Gebiss die oberen Frontzähne der flachen Ausbildung und starken Abnutzung der Höcker der Seitenzähne entsprechend, soweit nach oben und vorn gedrängt, dass sie den Bewegungen des Unterkiefers nicht mehr als Hemmnis entgegentreten.

Daraus resultirt eine Verschiebung des Oberkiefers im Bogen nach oben und eine mehr oder minder starke bogenförmige Ausbildung der Artikulationsebene. Im Zusammenhang hiermit steht wiederum eine ungleichmässige Verteilung des Kaudruckes, der auf der Höhe des Bogens am stärksten sein wird.

Hierdurch kann ein gleichzeitiges Vortreten des Nasofrontalpunktes nur verhindert werden.

Ein uneingeschränkter und Ausgedehnter Gebrauch des Gebisses, der ein Vortreten des Zwischenkiefers und schliesslich des gesammten Oberkiefers zur Folge hat, kann natürlich auch nicht ohne Einfluss bleiben auf die Configuration des Gaumens. Es unterliegt keinem Zweifel, dass der harte Gaumen in solchen Fällen an Länge nicht unbedeutend zunimmt, mit ihm natürlich auch der Alveolar- und der Zahnbogen.

Die Zähne gewinnen auf diese Weise genügend Raum für eine normale Entwicklung und Einstelung.

Der dritte Molar hat in den weitaus meisten Fällen Platz genug, alle charakteristischen Merkmale der Molaren auszubilden und sich diesen normaliter anzureihen, wir finden ihn vor dem aufsteigenden Aste des Unterkiefers eingelagert, voll entwickelt und funktionsfähig.

Anders beim orthognathen Gebiss.

Mit der Verminderung der Gesamtlänge des harten Gaumens, die hier stattgefunden hat, gehen zwei Folgewirkungen einher; entweder der Alveolarbogen wird verkürzt und in Folge dessen hat der Zahnbogen eine geringere Ausdehnung, oder der Alveolarfortsatz behält seine absolute Länge und der harte Gaumen nimmt beträchtlich an Breite zu. Verkürzungen der Totallänge des Alveolarbogens geben Anlass zu unzähligen Abweichungen von der normalen Zahl und Stellung der Zähne und lassen vor allem eine normale Entwicklung der dritten Molaren nicht zu.

Eine andere wichtige Erscheinung, die nicht übersehen werden darf bei der Beurteilung prognather Formen, die im engsten Zusammenhang steht mit der Bildung des Zahnbogens des Alveolarteils und der Richtung des gesamten Oberkiefers, ist die Stellung der flügelar-

tigen Fortsätze des Keilbeins zur Schädelbasis.

Es steht fest, dass der Winkel, den der Processus pterygoideus zur Basis cranii zum Körper des Hinterhaupt- und Keilbeins bildet, analog dem Unterkieferwinkel in den verschiedenen Alterstufen und unter besonderen Einflüssen sich ändert.

Beim Kinde ein mehr oder minder stumpfer Winkel, nähert er sich im späteren Alter allmählich dem rechten, sinkt manchmal sogar bis zu einem spitzen Winkel herab.

Gegen das Greisenalter hin beobachten wir wieder einen stumpfen Winkel, besonders in den Fällen, wo ein frühzeitiger Verlust der Zähne eine totale Resorption des Alveolarfortsatzes herbeigeführt hat.

Erklärlich erscheint diese Thatsache, wenn man bedenkt, dass der überaus starken funktionellen Reizen ausgesetzte Oberkiefer sich direkt an die flügelartigen Fortsätze anlehnt, die gleichsam Strebepfeiler für ihn bilden.

Die durch die Funktion des Gebisses geschaffenden Druckverhältnisse werden vom Oberkiefer aus den flügelartigen Fortsätzen übertragen, jede Veränderung der Kraftrichtungen muss auch ihre Stellung beeinflussen. Weichen die flügelartigen Fortsätze dem Drucke des Oberkiefers nach rückwärts aus- das wird dann hauptsächlich der Fall sein, wenn der Hauptkaudruck möglichst weit nach rückwärts fällt- so wird der in Rede stehende Winkel sich verkleinern. Eine Vergrösserung dagegen tritt ein, wenn der Oberkiefer vorgeschoben wird. Der Ausschlag wird dann am grössten sein, wenn die Bewegung in Kreislinie nach oben erfolgt, wie es ganz besonders bei der konstanten physiologischen Prognathie zu beobachten ist.

Es soll nicht damit gesagt sein, dass anders geartete Prognathismen einen verhältnismässig grossen Basiswinkel ausschliessen, auch sie werden solche begünstigen, aber lange nicht in dem Maasse, wie die konstante physiologische Prognathie.

Die Winkelmessungen, die ich leider nur an einer relativ geringen Anzahl von Schädeln vornehmen konnte, entsprechen meiner Anschauung und liefern ähnliche Resultate, wie sie von Betz* erzielt worden sind, der der Stellung der flügelartigen Fortsätze ganz besondere Aufmerksamkeit schenkte.

Betz kommt nach Durchführung seiner Messungen zu dem Schluss, dass der Winkel, den die flügelartigen Fortsätze mit der Schädelbasis bilden, bei aussereuropäischen Rassen erheblich grösser ist, als bei der europäischen, er deutet bereits an, dass der stumpfe Winkel besonders den Prognathen zukäme.

Nach seinen Messungen, die zahlreich genug sind, eine Schlussfolgerung zuzulassen, beträgt der in Rede stehende Winkel bei den europäischen Völkern 70-80°, häufiger weniger als mehr, bei den aussereuropäischen 85-90°.

Ich konnte in mehreren Fällen physiologischer Prognathie einen über 90° hinausgehenden Winkel konstatiren.

Noch auf eine andere Erscheinung möchte ich aufmerksam machen, die meines Wissens bisher mit der Prognathie nicht in Zusammenhang gebracht ist, die mir aber als wertvolles Merkmal der in Rede stehenden Formation erscheint und die gleichzeitig ein Streiflicht wirft auf ihre Aetiologie-ich denke an die Gestaltung der Zähne, speziell der Frontzähne, an

* Zeitschrift für rationelle Medizin. Zweiter Band. Heidelberg. 1852.

die Form ihrer Kronen und den Verlauf ihrer Wurzeln.

Damit berühre ich ein Gebiet, das bisher arg vernachlässigt worden ist—die Ethnologie der Zähne—aufgefasst im Sinne der beschreibenden Zahnkunde, so weit sie sich rein ethnographisch bezieht auf die normalen Verschiedenheiten der anatomischen Gestaltung der Zähne und der Kiefer, die typisch genug sind, um ethnographisch wertvoll zu erscheinen.

Wohl sind Beobachtungen gemacht und Thatsachen gesammelt, die sich beziehen auf gewisse Erkrankungen, Abnormitäten und Bearbeitungen der Zähne, aber in Bezug auf die geringfügigen anatomischen Unterschiede ist anthropologischerseits nichts geleistet.

Der Ausspruch Mantegazza's, dass eine ethnoligische Studie der Zähne noch erst gemacht werden müsse und charakteristische Merkmale von grosser Bedeutung zu Tage fördern würde, besteht auch heute noch zu Rechte und sollte vor allen Dingen uns Zahnärtzte, die wir über eine genaue Kenntnis der Zähne verfügen und die kleinsten Besonderheiten an ihnen sicher zu finden und fest zu halten wissen, dazu bestimmen, unsere Studien in das Gebiet der Anthropologie auszudehnen, zum Vorteil auch unserer Wissenschaft. Allerdings wird die Arbeitskraft Einzelner nicht ausreichen, ein solches Thema abschliessend und mit Erfolg zu behandeln.

Der Mangel an verwendbaren Daten ist zu gross, die Fülle des erforderlichen Materials zu ungeheuer für eine wissenschaftliche Abhandlung der Ethnologie der Zähne.

Umsomehr aber sollte es Niemand versäumen, gelegentlich auf etwaige besondere Merkmale an den Zähnen aufmerksam zu machen und sie möglichst zu fixiren.

So glaube ich auch bei der Besprechung der Prognathismen die Zahnform an und für sich nicht ausser Acht lassen zu dürfen.

Meine Beobachtungen betreffen in diesem Falle vorzüglich die Frontzähne.

Ich habe den Eindruck gewonnen, dass die Kronen der oberen wie der unteren Frontzähne massiger sind, als beim orthognathen oder auch beim pathologisch-prognathen Gebiss, dass besonders das Congulum nicht so scharf abgesetzt ist nach der Schneide zu, sondern dass mehr die reine Keilform vorherrscht. Vielleicht steht diese Formation im Zusammenhang mit der Artikulationweise der Frontzähne im Verlaufe dieser Generationen.

Ausserdem fiel mir in Fällen konstanter physiologischer prognathie die starke Krümmung der Frontzahnachse auf, deren Concavität lingualwärts gerichtet ist.

Am wenigsten beim mittleren Schneidezahn, am meisten beim Eckzahn ausgeprägt, betrifft sie die ganze Gruppe der oberen Frontzähne. So kommt es, dass trotz der auffallenden Schräglegerung des Alveolartheils die Zahnkronen annähernd orthognath gerichtet sind, so kommt es ferner, dass der vordere Teil des harten Gaumens immer noch gewölbt erscheint. Ich komme noch später einmal auf diese Verhältnisse zurück.

Die meisten wilden Stämme sind in unserem Sinne mehr oder minder prognath und die fossilen menschlichen Ueberreste sind es fast stets.

Gleichzeitig sind die Kiefer massiger und kräftiger der horizontale Kieferast ist kleiner, Gaumen und Alveolarfortsätze sind verlängert so dass auch die dritten Molaren vollständig ausgebildet sind.

Diese Thatsachen sind geeignet, die

Auffassung zu begründen, dass die im Rede stehende Gestaltung der Kiefer das Resultat einer intensiven Funktion des Kauorganes ist; dementsprechend ist sie als eine physiologische Erscheinung, auch wohl als ethnologisches Merkmal, niemals aber als etwas Pathologisches anzusehen.

Die funktionelle Gestaltung der Kiefer und Zähne, so wie ich sie für diese Art der Prognathie beschrieben habe, ist aber nur dann möglich, wenn schon frühzeitig die bildenden Kräfte einwirken.

Das ist meines Erachtens ein Punkt, der durchaus nicht übersehen werden darf.

Es ist die Vermutung ausgesprechen, dass die physiologische beide Kiefer betreffende Prognathie besonders bei den Negerrassen auf eine intensive und sich weit über die normale Zeit erstreckende Ausführung des Säuggeschäftes zurückzuführen ist.

Dieses ätiologische Moment hat aber durchweg keine Anerkennung gefunden, mann hat es als unwesentlich bei Seite geschoben.

Wenn auch feststeht, dass im Allgemeinen die schwachen Bewegungen der Kiefer des Säuglings beim Nehmen der Nahrung nicht im Stande sind, individuell verschiedene Formen, wie wir sie nach der zweiten Dention beobachten können, bereits während des Bestehens des Milchzahngebisses zu zeitigen, so ist das noch lange kein Beweis dafür, dass der funktionelle Reiz, der ohne Zweifel durch das Säuggeschäft auf den vorderen Teil des Oberkiefers ausgeübt wird, zumal wenn dasselbe bis ins dritte und vierte Jahr fortgesetzt wird, ohne Einfluss auf die Richtung der bleibenden Frontzähne und die Form des Oberkiefers bleibt. Ebenso bin ich der Ueberzeugung, dass sobald die Verarbeitung fester Nahrungsmittel dem Kinde einen freien und willkürlich ausgedehnten Gebrauch seines Gebisses gestattet, dessen mehr oder minder starke Inanspruchnahme weniger die eigene (des Milchgebisses) Gestaltung, als vielmehr die Entwicklung und Ausbildung des bleibenden Gebisses beeinflusst.

Denn diese Richtung und die erste Einstellung der durchbrechenden bleibenden Zähne ist zunächst abhängig von der inneren Struktur des Oberkiefers, die ihrerseits in der Hauptsache das Resultat der Funktion des Milchzahngebisses ist.

Je intensiver das Säuggeschäft, je länger es ausgeüb wird, je kräftiger die Beiss und Kaubewegungen des Milchgebisses sind, um so stärker werden die Druckbahnen sich über ihnen ausbilden.

Je häufiger ein horizontaler Druck oder Zug auf den Alveolartheil des noch zahnlosen Kiefers oder auch auf die Milchzähne einwirkt, um so schräger werden die Trajektorien verlaufen, um so schräger stellen sich auch die Keime der bleibenden Zähne ein, die der Beanspruchung des Knochens nach möglichkeit folgen.

Es darf nicht unerwähnt bleiben, dass ein uneingeschränkter intensiver Gebrauch der ersten Zähne auch schon dem Milchgebis das Siegel der Prognathie aufzudrücken vermag.

So finde ich beispielsweise bei F. Thomsen* folgende Notiz:

"Als das Massaikind (die Massai sind ein kriegerischer Stamm Deutsch-Ost-Afrikas) über seiner Mutter Milch hinaus war, übte es seine hervorbrechenden Zähne an einem grossen klumpen Rindfleisch. Freilich war dies eine sehr tadelnswerte Neigung unseres Freundes, denn sie ist jedensfalls an jener häss-

* F. Thomsen. Durch Massailand. p. 374.

lichen Stellung der Zähne Schuld, welche er mit seinen übrigen Stammesgenossen gemein hat.

"Da das Zahnfleisch noch zart, das Rindfleisch aber zähe war, so nahmen die Zähne eine Stellung nach aussen an, die nicht hübsch aussieht."

Die oben als Eigentümlichkeit der konstanten physiologischen Prognathie erwähnte gleichartige Krümmung der Wurzeln der Frontzähne deutet darauf hin, dass bereits vor Abschluss des Wurzelwachstums die prognathe Bildung angelegt ist, und kann als wichtiges ätiologisches und differenzirendes Moment angesehn werden.

Die Wurzelkrümmung resultirt, wie ich bereits oben ausgeführt habe, aus einer dauernden Verschiebung der Kraftrichtungen während des Wurzelwachstums.

Der Zahn giebt die Richtung, die ihm die innere Strukter des Knochens vor seinem Durchbruch vorgeschrieben hat, nach seinem Durchbruch auf, weil er nun der Angriffspunkt starker Kräfte wird, die ihn nach innen drängen.

Die Ablenkung der Zahnkronen lingual wärts verrät sich durch eine mehr oder minder concav nach innen gekrümmte Wurzel.

Hiermit glaube ich diese Form genügend bestimmt und von anderen prognathen Bildungen abgegrenzt zu haben.

Den Uebergang zu der pathologischen Prognathie vermitteln uns die Formen, die ich ihrer Aetiologie entsprechend noch als physiologische ansehe, die ich aber ihrer Unbeständigkeit wegen als progressive bezeichne.

Allerdings entspricht diese Auffassung der bisher üblichen Definition der Prognathia physiologica nicht.

Halten wir fest an der Definition: Prognathia physiologica sive ethnologica ist das oben und unten vorstehende Gebiss, bei welchem die Art des Zusammentreffens der unteren und oberen Vorderzähne dieselbe ist, wie beim sogenannten normalen Biss-, so dürfen wir das Vorspringen des Oberkiefers für sich, wie es manchen Rassen, insbesondere der malayischen eigentümlich ist, weder als physiologische noch als ethnologische Prognathie bezeichnen, obgleich diese Bildung durchaus nicht aus pathologischen oder anormalen Verhältnissen hervorgeht, sondern in der Hauptsache das Resultat besonderer Ernährungsweise und gewisser Lebensgewohnheiten ist.

Das Abreissen und Zerren roher, vor Allem unvorbereiterer Pflanzennahrung manche Lebensgewohnheiten, wie z. B. das unter den Malayen weitverbreitete Betel- und Sirikkauen, setzen vorzugsweise die Frontzähne unter einen Zug in horizontaler Richtung.

Wenn man bedenkt, das schon, wie Engel* überzeugend nachgewiesen hat, der bei mässiger und normaler Kaufunktion zur Geltung kommende Druck auf die Ober- und Unterkieferzähne ungleichmässig, nämlich im Verhältnis von 2, 5 : 2, 1 verteilt ist, so kann man leicht einsehen, dass eine die oberen Zähne bevorzugende Funktion eine gegenseitige Verschiebung beider Zahnreihen zur Folge haben muss, so dass die normale Artikulation gestört wird.

Daran zweifelt wohl Niemand, dass bei ganz intakten Gebissen auch schon bei mässiger Funktion die Zähne eine allmählige Veränderung ihrer Richtung und Stellung erleiden und dass sie denjenigen Teil des Kiefers, in den sie eingerammt sind, nach und nach mit sich ziehen.

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* Engel. Der Einfluss der Zahnbildung auf das Kiefergerüst. Zeitschr. der k. k. Ges. d. Aerzte. Wien, 1849, p. 380.

Nun bedeutet ein Vorrücken stark in Anspruch genommener Frontzähne eine Lockerung des Zahnreihenschlusses, wodurch den Seitenzähnen die Möglichkeit gegeben wird, auch ihrerseits mesialwärts vorzurücken.

Die hauptsächliche Ursache der Annäherung der Seitenzähne ist der beim Kauen auf sie ausgeübte Druck. Derselbe ist bei geschlossenen Kiefern nahezu parallel zu den Achsen der Zähne.

Wird jedoch ein Körper zermalmt so entfernen sich beide Kiefer von einander, die Achsen der Antagonisten sind nicht mehr parallel, sie stehen im stumpfen Winkel zu einander, der um so kleiner wird, je weiter sich der Mund öffnet.

So müssen die Zähne durch den Kaudruck mesialwärts geschoben werden sobald der Zahnreihenschluss im Bereiche des vorderen Oberkiefers gelokkert ist.

Charakteristisch für die in Rede stehende Form der Prognathie ist das gleichmässige bilaterale Vordringen sämtlicher oberen Zähne, so dass das normale Artikulationsverhältnis mit den unteren Zähnen auf beiden Seiten gleichartig gestört wird.

Berührt beispielsweise der zweite obere Prämolar den ersten unteren Molaren überhaupt nicht mehr, während seine mesial Kante bereits die distale des unteren Prämolaren begrenzt.

Die Wurzeln der oberen Frontzähne zeigen kein gleichmässiges Krümmungsmerkmal und dementsprechend liegt der Subnasalpunkt annähernd in der Richtungsebene der Kronen der mittleren Frontzähne, was darauf hindeutet, dass sich die Prognathie erst nach Abschluss des Wurzelwachstums entwickelt hat.

Abgesehen von ganz besonderen Graden des Vorstehens ist die Funktion des Gebisses bei dieser Formation nicht sehr beeinträchtigt. Ich bemerke aber, dass letztere die Tendenz hat, immer höher werdende Grade anzunehmen, weshalb ich sie als progressive physiologische Prognathie bezeichne.

Sie ist ferner dadurch gekennzeichnet, dass trotz auffallender Schräglagerung des Alveolartheils und der Zähne gewöhnlich ein relativ grosser, der Orthognathie sich nähernder Mittelgesichtswinkel besteht.

Das deutet uns die Art der Bewegung der Frontzähne an. Sie werden nicht etwa in gerader Linie vorgeschoben,- wäre das der Fall, so würde auch der Subnasalpunkt entsprechend vorrücken und einen relativ kleinen Mittelgesichtwinkel bedingen-, sondern sie bewegen sich im Bogen nach vorn und oben annährend so, dass die Schneide einen Kreisbogen um die Wurzelspitze beschreibt, die allerdings auch nicht ganz in ihrer Lage verharrt, auf alle Fälle aber nicht nach vorn rückt.

Die Richtung und Lagerung der Wurzelspitze wird massgebend für die Lokalisation des funktionellen Reizes und bedingt auf diese Weise die Position des Subnasalpunktes.

Das deutet gleichzeitig darauf hin, dass neben den Zerr- und Reissbewegungen auch die Bewegungen des Unterkiefers nach der Seite hin kräftig zur Geltung gekommen sind.

Im Allgemeinen scheint mir diese Bildung entsprechend ihrer späteren Entwicklung Profil und Kiefer nicht in dem Maasse zu modificiren, als die konstante physiologische Prognathie.

Das Hauptkoncentrationslager des Kaudrukkes fällt schon mehr nach rückwärts, die flügelartigen Fortsätze sind nicht in dem Grade schräg gelagert, als bei der konstanten physiologischen Prognathie.

Die unteren Zähne stehen orthognath.

Bevor ich zu der Beschreibung der

pathologischen Prognathie übergehe, möchte ich mich noch aussprechen über die Prophylaxe und Orthopädie der eben behandelten physiologischen Formen. Es erscheint zweifellos unnatürlich und überflüssig, physiologisch bedingte Bildungen einer Aenderung zu unterwerfen durch willkürliche Massnahmen.

Der Umstand aber, dass die ausgesprochene konstante wie progressive physiologische Prognathie sich besonders unter den Völkern findet, die die Zähne künstlich zu irgend einem Zwerk zu bearbeiten oder auch die Form des Zahnbogens zu verändern pflegen, legt die Frage nahe, ob etwa diese beiden Erscheinungen in einem näheren Verhältnisse zu einander stehen.

Gelegentlich meiner Untersuchungen über die künstliche Deformation des Gebisses konnte ich diesen Zusammenhang mit Sicherheit nachweisen.

Die Zähne sind unter den Völkern ein auffallendes Objekt gewaltsamer Eingriffe und Umgestaltungen im Dienste des subjektiven Schönheitsgefühls. Dass sie in dieser Richtung eine bedeutende Rolle spielen, ist leicht erklärlich, denn sie sind ein so wichtiges, vor allen anderen auffallendes Organ, dass selbst die kleinsten Veränderungen, mögen sie rein physiologischen oder pathologischen Ursprungs oder durch äussere Einflüsse erworben sein, eine sichere Gewähr leisten, als Merkmal eines Individuum zu gelten.

Es unterliegt keinem Zweifel, dass die Zähne auch für sich allein betrachtet einen gewissen Einfluss auf den Gesichtsausdruck ausüben, mehr noch bei farbigen Völkern, als bei der weissen Rasse.

Während der Kulturmensch alles aufbietet, seine Zähne zu erhalten oder deren Verlust durch die Kunst zu ersetzen, nehmen die Naturvölker an diesem wichtigen, beinahe unentbehrlichen Organe ganz abnorme Verstummelungen vor, indem sie ihre Zähne teils kurz oder spitz feilen, teils aus ihrer Stellung drängen, färben oder auch ganz ausschlagen.

Unter den Deformationsarten scheint mir besonders das Ausschlagen, das Horizontalfeilen und das Verdrängen der Zähne aus ihrer Stellung in Beziehung zu stehen zur Prognathie und zwar nehme ich an, dass diese Handlungen vielfach vorgenommen werden in der Absicht, die Prognathie zu verhüten oder abzuschwächen oder aber auch sie zu verstärken.

Hier wird meiner Ansicht nach hauptsächlich das ästhetische Empfinden eines Volkes das Ausschlaggebende sein.

Virchow machte bereits gelegentlich der Besprechung der Prognathie darauf aufmerksam, dass es ein interessantes Problem sei, zu ermitteln, in wie weit die verschiedenen Arten der künstlichen Einwirkung die Form des Gebisses im Ganzen, die Gestalt der Zahnkurze des Gaumens und der Kiefer ändern.

Das frühzeitige Ausschlagen und die horizontale Abfeilung der oberen Frontzähne scheinen mir als wirksame prophylaktische Maassnahmen hinsichtlich der konstanten wie der progressiven physiologischen Prognathie in Betracht zu kommen.

Das frühzeitige Ausschlagen und die Zähne kann als die roheste, am wenigsten milde Art der künstlichen Einwirkung gelten. Es werden je nach den Stämmen obere oder untere einer oder mehrere Schneidezähne seltener Eckzähne ausgerissen.

Die Sitte wird des Zahnwechsels wegen mit dem 10 oder 12 Jahre oder bei der Mannbarkeitserklärung ausgeübt.

Dieser Typus der Zahndeformirung hat ein ausgedehntes Verbreitungsgebiet. Für das Ausbrechen der Zähne kommen

besonders die Neger und Australier in Betracht nur ganz vereinzelt findet es sich bei den asiatischen Malayen, auf dem Festlande von Hinterindien und unter den Eingeborenen Amerikas.

Ich habe mich bemüht, die Gründe, die die Völker zur Befolgung dieser Sitte bewegen, aufzufinden.

Man kann hier nur Vermutungen aufstellen, denn die Erklärungen der Leute, die sich der Deformation unterworfen haben, bieten allzuwenig Anhaltspunkte, zumal da sie vielfach nicht einen, zwei oder drei, sondern, wenn man noch alle möglichen Detailmotivirungen in Betracht zieht eine sehr grosse Anzahl von Gründen angeben, durch welche sie sich direkt oder nur in dunklen Vorstellungen zur Befolgung der Sitte getrieben fühlen, und eine allgemein gültige Ansicht über den Grund der Verstümmelung in den meisten Fällen nicht besteht.

Man ist darum auch nicht berechtigt eine einzelne, wenn auch vorwiegende Begründung mit Uebergehung der übrigen, als die von ihnen selbst angegebene, als die einzig richtige anzunehmen.

Es ist aber bemerkenswert, dass viele von den Wilden, die das Ausbrechen der oberen Frontzähne bald nach dem Zahnwechsel besorgen, den Berichten der Reisenden zufolge, diese Sitte damit begründen, dass sie nicht wie die Tiere aussehen wollten, nicht etwa Hunden oder Affen gleichen möchten.

So berichtet beispielsweise Holub von den Maschukulumbe, einem Stamme im Norden des mittleren Sambesi, dass sie alle oberen Vorderzähne frühzeitig auszögen, was ein Einsinken der Oberlippe zur Folge hatte. An diesem Vorgange hätten die Frauen grosse Schuld. Sie meinten: "Männer, die mit ihrem ganzen Gebiss essen, sind wie die Pferde und wir wollen keine Pferde als Gatten haben."

Dass durch das frühzeitige Entfernen zweier oder mehr Schneidezähne der Oberkiefer und zugleich das ganze Profil des Gesichtsschädels eine andere Form und einen anderen Ausdruck gewinnen, lassen besonders die Untersuchungen, die Rüdinger an künstlich deformirten Schädeln von Südsee-Insulanern (Neue Hebriden) machte, bei denen obere Schneidezähne absichtlich entfernt waren, unzweifelhaft erscheinen.

"Was das Oberkiefergerüst betrifft," sagt Rudinger, "so erlangt dasselbe an jenen Schädeln, an denen die beiden mesialen Schneidezähne weggenommen wurden, einen eigenartigen Habitus. Da, wo die Schneidezähne entfernt waren, entsteht durch Knochenatrophie ein Alveolarrand mit zugeschärften Rändern.

"Die beiden Oberkiefer sinken bis zur unteren Umrandung der Apertura etwas ein, die Spina nasalis schwindet und das Profil erfährt eine 'Ablenkung.' Eine nicht so weit gehende Umgestaltung des Profils wird durch die Horizontalfeilung bedingt, die besonders unter den Stämmen Verbreitung gefunden zu haben scheint, die die progressive physiologische Prognathie in grösserer Häufigkeit aufweisen, vor allen unter den Malayen."

Ich konnte regelmässig constatiren, dass die Malayenschädel, an denen die Zähne bis über die Hälfte der Krone abgeschliffen waren, die unter diesem Volke so häufig anzutreffende Prognathie des Oberkiefers nur in sehr geringem Grade zeigten.

Natürlich wird der Zeitpunkt der Bearbeitung hier eine grosse Rolle spielen, je frühzeitiger diese erfolgt ist, um so weniger prognath wird der Oberkiefer sein.- Die Ausdehnung und Form

der durch die Feilung freigelegten Pulpenhöhle ermöglicht es uns zu beurteilen, wann ungefähr die Deformation vorgenommen ist.

Wie können wir uns aber diesen Effert der willkürlichen Umgestaltung der Zähne erklären?

Für die Beurteilung der Bewegung der Frontzähne nach vorn und im Bogen nach oben müssen wir folgende Umstände ins Auge fassen.

Wie schon Engel bemerkt, ist jeder Zahn als einarmiger Hebel aufzufassen, dessen Dreh und Unterstützungspunkt an der Wurzelspitze sich befindet.

Auf den Frontzähnen lastet, wie ich bereits im ersten Teil meiner Arbeit ausgeführt habe, ein Druck in der langen Achse des Zahnes und ein Zug, der in mehr oder minder horizontaler Richtung wirkt. Dieser letztere ist es besonders, der das Vordringen und die Schräglagerung der Frontzähne bedingt.

Der Widerstand aber, der sich ihm entgegensetzt, wird geleistet von der Knochenlamelle des Alveolarfortsatzes, und dieser Widerstand wird um so leichter überwunden, je länger im Verhältnis zur Zahnwurzel die Zahnkrone ist und je näher der Schneide der Horizontaldruck zur Geltung kommt.

Hierin liegt das ganze Geheimnis der prophylactischen Wirkung der horizontalen Abfeilung.

Was mich besonders auf diesen Zusammenhang aufmerksam gemacht und was mich zu der Annahme gebracht hat, dass die Verunstaltungen vielfach vorgenommen werden, um das Vorstehen der Kiefer zu verhindern, sind die sich häufig wiederholenden und bestätigenden Auslassungen der Völker über die Gründe, die sie zur Ausführung der Deformation treiben.

Kremer* sagt, die Javanen hätten ihm auf die Frage, warum sie die Zähne feilten, zur Antwort gegeben:

"Viele von uns haben ein unegales Gebiss, ein Zahn ragt oft vor den anderen vor und die Lippe ist aufgeworfen, weil alle Zähne zu weit vorstehen. Dieses kommt daher, dass wir beim Essen alles mit den Zähnen abreissen und anziehen und so sehen wir schon in der Jugend wie Hunde oder Affen aus, wie man uns auch schilt; das Feilen der Zähne giebt dem Munde nun wieder eine menschliche Form."

Hasselt† erzählt Aehnliches von den Malayen, die von jemandem, dessen Zähne noch ungefeilt sind, sagen:

"Saroman singganz wie ein Hund.

"Bei den Battahstämmen scheint die unmittelbare Ursache des Feilens in dem Umstande zu liegen, dass ihre Schneidezähne von Natur meist so gross sind, dass sie die Lippen nicht schliessen können, was einerseits unbequem, andererseits auch nach ihren Begriffen dem Gesicht leicht einen dummen und unangenehmen Ausdruck giebt."

Diese, unserm europäischen Empfinden entsprechende Anschauung scheint vorzugsweise den malayischen Stämmen eigen zu sein, unter den Negervölkern ist sie nur vereinzelt anzutreffen. Eine ganze Reihe von Stämmen ist vielmehr der entgegen gesetzten Ansicht, dass nämlich ein prognathes Profil ausserordentlich gefallen müsse; sie sind deswegen auch bestrebt, die Vorderzähne und mit ihnen den Zwischenkiefer möglichst weit vorzudrängen.

Wir dürfen uns über diese Geschmacks-

* Vergl. Brenner, Besuch bei den Kanibalen Borneos, p. 193.

† *Ibid.*

richtung nicht wundern, denn es unterliegt keinem Zweifel, dass die ästetischen Begriffe zunächst ganz von der Gewohnheit des Anblickes abhängen.

In diesem Sinne ist anzunehmen, dass der künstliche Prognathismus nicht nur in Nachahmung natürlicher menschlicher, sondern auch tierischer Formen ausgeführt ist, wie manche anderen Verunstaltungen des Körpers.

So sagt Ranke*: "Die Naturvölker kennen die mannigfachen Eigenschaffen, in welchem die Tiere den Menschen trotz seiner geistigen Ueberlegenheit überragen, vollkommen und wir konnen uns nicht wundern, wenn sie, wie es ja auch unsere Helden getan haben, als Ehrennamen die Namen von Tieren annehmen.

"Ganze Volkstämme legen sich den Namen eines Tieres als Volksnamen bei, und mehrfach finden wir mit dieser Sitte die andere verbunden, sich auch äusserlich dem gewählten tierischen Vorbild möglichst zu nähern.

"Hierauf beruhen die künstlichen Kopfumformungen, die Haartrachten, Tätowirungen und besonders auch die Bearbeitungen der Zähne."

Das künstliche Vordrängen der Zähne ist eine wenig verbreitete, auf Afrika beschränkte Erscheinung.

Faidherbe† berichtet sie uns von der aus Arabern, Berbern und Negern gemischten Bevölkerung am Senegal.

Bei manchen Frauen sind daselbst die Schneidezähne des Oberkiefers in sehr auffallendem Grade vorragend, was auf folgende Art erzielt wird: "Schon die Milchzähne werden zu diesem Zwecke den Mädchen mit einer Zange ausgezogen und die definitiven Zähne nach vorn gedrängt, was vollständig genügt, einen künstlichen dentalen Prognathismus zu erzeugen."

* Ränke. Der Mensch.

† Faidherbe. Sur le prognathisme artificiel des mauresques du Senegal. Bull. de la Soc. d'Anthrop. de Paris. 2. sér. t. vii. 1872.

Die Folgen dieser Verunstaltung sind keine unbedeutenden. Der im Oberkiefer willkürlich erzeugte Prognathismus muss compensirend auf den Unterkiefer übergehen, indem der Mittelteil des Unterkieferkörpers samt den Schneidezähnen sich vorneigt, um den weitausladenden Oberkiefer zu erreichen. Hierdurch wird die Profillinie winkelig abgeknickt und der Mund selbst schnauzenartig vorgetrieben.

Die berührten Verhältnisse müssen die Contouren des Gesichtes in ganz hervorragender Weise modificiren; die Schneidewand und die Flügel der Nase werden nach vorne gerichtet und Nasenöffnung nach vorne gerichtet und diese Aufwärtsbiegung muss unbedingt eine Abflachung des knöchernen Nasenrückens zur Folge haben.

Auch unter einigen Stämmen Ostafrikas wird dieser künstliche Prognathismus angetroffen.

So berichtet Baumann* von dem kriegerischen Volke der Massai, dass bei beiden Geschlechtern die beiden oberen mittleren Schneidezähne vorgebogen werden.

Die Wataturi, sprachlich nahe Verwandte der Massai, haben sich ebenfalls diesem Gebrauche angeschlossen.

Ferner bringen nach Baumann die Wafiomi, ein hamitischer Volksstamm, der die Landschaften Ufiomi, Iraki, Uassi und Burungu bewohnt, die oberen Schneidezähne vor.

* Baumann. Durch Massailand zur Nilquelle.

Auch Stuhlmann* berichtet den künstlichen Prognathismus von den Wakamba, Wataiti, den Völkern der Kilimandscharo-Niederung und Usambaras.

Die durch willkürliche Maasnahmen entstehenden prognathen Formen berühren schon mehr das Gebiet des pathologischen Prognathismus; sie lassen sich gut vergleichen mit den Bildungen, die ihre Entstehung dem Daumen- und Beutellutschen, dem Lippenbeissen und anderen nicht lobenswerten Angewohnheiten verdanken.

Weit mehr als die physiologischen interessiren uns als Zahnärzte die pathologischen Formen der Prognathie, insbesondere ihre Prophylaxe und ihre orthopädische Behandlung.

So einheitlich und bestimmt uns die physiologische Prognathie in ihren Formen erscheint, so mannigfaltig und schwer zu begrenzen ist der pathologische Prognathismus.

Hier besteht eine so grosse Variabilität der Formen, dass man unmöglich mit ein paar Sätzen eine allgemein gültige und ausreichende Definition schaffen kann.

Ist dieses trotzdem versucht worden, so zeigt sich jedesmal, dass die einzelne in diesem Sinne gemachte Erklärung auf einer allzu einseitigen Auffassung des Begriffes "Prognathia pathologica" basirt, dass sie für manche Formen zwar bindend, für andere wieder nicht zutreffend ist.

In allgemeinen hat man zuviel Gewicht gelegt auf das Verhältnis der beiden Zahnreihen zueinander, während Kieferformation und Stellung sowie der Aufbau des Profils und der Ausdruck des Gesichtes bis vor kurzem kaum berücksichtigt worden sind. Ich erinnere nur an Carabelli der als Grenze zwischen normal und prognath einen Abstand der unteren vorderzähne von den oberen von 2 mm. angiebt.

Wenn auch seine Erklärung, die weder eine Art noch einen Grad von Prognathie zu kennzeichnen im Stande ist, schon dadurch bedeutend an Wert verliert, dass Carabelli noch nicht die physiologische Prognathie von der pathologischen zu unterscheiden wusste, so kann man ihr doch einen grossen Einfluss auf die Auffassung späterer Autoren nicht absprechen, die selbst dann noch, als man erkannt hatte, dass die Prognathie keine einheitliche Formation darstelt, und aus den verschiedensten Umständen resultiren kann, in dem gegenseitigen Verhältnis der beiden Zahnreihen das Ausschlaggebende suchten.

Ich will durchaus nicht bestreiten, dass die Art des Zusammentreffens der Zähne ein wichtiges diagnostisches Moment darstellt, aber eine durchgehende differenzirende Bedeutung kann ich ihr nicht beimessen diese gewinnt sie erst dann, wenn sie in Beziehung gesetzt wird nicht allein zu den eventuellen Ursachen, sondern auch zu der Lagerung und Form des Alveolarfortsatzes, des Gaumens, der Kiefer und vor allem auch zum Gesichtswinkel. So zeigen beispielsweise die prognathen Bildungen die durch den hervortretenden, schräg gelagerten Zwischenkiefer bedingt sind, vielfach ganz dieselben Artikulationsverhältnisse, wie die Formen die aus einer mangelhaften Entwicklung des Unterkiefers resultiren.

Verfügt man nicht über ein fixe Linie, zu der die Umrisse des unteren Gesichtsschädels leicht in Beziehung gesetzt werden können, so wird es besonders in weniger ausgesprochenen Fällen der in individuellen Anschauung überlassen

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* Stuhlmann. Mit Emin Pascha ins Herz von Afrika.

bleiben müssen, ob die Ursache des Missverhältnisses im Bereiche des Oberkiefers oder des Unterkiefers zu suchen ist.

In diesem Sinne halte ich auch die von Sternfeld in neuerer Zeit gegebene Definition der pathologischen Prognathie nicht für ausreichend, wenn ich im übrigen auch seine Ausführungen hoch schätze.*

Er versteht unter Prognathie pathologica die anormale Stellung der oberen Vorderzähne, die bedingt ist durch übermässiges Wachstum des gesamten Oberkiefers oder nur seines intermaxillaren Teiles, durch eine zum Kieferumfang übermässige Grösse der Zähne, sowie durch Verkürzung des Querdurchmessers des Gaumens in der Region der zweiten Bicuspidaten.

Bei dieser Prognathie erreichen nach Sternfeld die Kaukanten der unteren Vorderzähne bei geschlossenen Zahnreihen die oberen Vorderzähne nicht mehr; sie treffen den harten Gaumen, oder berühren im günstigsten Falle die Hälse der oberen Zähne.

Auf die Aetiologie der pathologischen Prognathie übergehend, führt Sternfeld aus, dass eine übermässige Entwicklung des Oberkiefers bei normaler oder gehemmter Entwicklung des Unterkiefers, ferner normale Entwicklung des Oberkiefers und gleichzeitige Entwicklungshemmung des Unterkiefers ein vorstehen der oberen Zähne bedingt, dass selbst eine mangelhafte Ausbildung des Oberkiefers ein Vortreten der vorderen Zähne verursachen kann, wenn diese zufolge ihrer mit dem Kiefer in einem Missverhältnis stehenden Grösse nicht genügend Raum finden, um einen elliptischen Zahnbogen zu bilden.

* Ueber Bissarten und Bissanomalien. Eine Studie von Dr. Alfred Sternfeld. München, 1888.

Als derartig fehlerhafte Gestaltungen sind namentlich der soggenannte V förmige und der contrahirte Kiefer zu bezeichnen.

Bei dem V förmigen Oberkiefer bildet die obere Zahnreihe nicht einen Bogen, sondern es liegen die Zähne jeder Hälfte in einer mehr oder minder geraden Linie und die Beiderseitigen Zahnreihen stossen in der Medianlinie unter einem spitzen Winkel zusammen.

Bei dem contrahirten Kiefer dagegen zeigt sich in der Gegend der Bicuspidaten eine Verschmählerung des Gaumendurchmessers. Beide Formen führen zur Prognathie.

Sternfeld's weitere Angabe, dass der pathologische Prognathismus sehr häufig dadurch zu Stande kommt, dass sich die ersten bleibenden Molaren mangelhaft entwickeln oder durch Caries vor dem Erscheinen der Prämolaren und Molaren zu Grunde gehen, entbehrt am wenigsten der begründung.

Der Unterkiefer verliert seine Stütze nach hinten und die ganze Kraft dessebeu wirkt dann auf die Basis der Kronen der oberen Schneidezähne, wodurch der Prognathismus zu Stande Kommt.

Das ist vielerseits bestätigt worden.

Schliesslich werden noch als Ursache pathologischer Prognathie erwähnt manche üble Gewohnheiten: Daumenlutschen, Lippenbeissen, Zungenpressen.

Neben den knappen anatomischen Daten fällt die eingehende Behandlung der ätiologischen Momente auf, denen Sternfeld mit Recht grosse Bedeutung beilegt, die er aber glücklicherweise nicht direct zur Classification der pathologischen Prognathie benutzt, wie es Kingsley bereits vor ihm durchgeführt hatte. Nach diesem Autor ist der Prognathismus des Oberkiefers bedingt.

1. durch Vererbung.

2. durch Daumenlutschen.

3. durch adenoid Vegetationen im Nasenrachenraum, wodurch die Kinder gezwungen werden, durch den Mund zu athmen.

Im Anschluss an die Kingsley'schen Ausführungen sind die Arbeiten Cartwright's, Coleman's, Mummery's und Talbot's erwähnenswert, die besonders die Vererbung als ein wichtiges ätiologisches Moment hinstellen. Sie alle sind durch eingehende Untersuchungen zu dem Resultat gekommen, dass die mangelhafte Entwicklung der Kiefer, auch sofern sie zu pathologisch-prognather Bildung Anlass giebt, desto seltener wird, je niedriger die Kulturstufe eines Volkes oder einer Rasse ist. Speciell werden von diesen Autoren der V förmige und der contrahirte Kiefer als Producte einer Art Degeneration aufgefasst.

Noch könnte ich eine ganze Reihe von Beiträgen zum Kapitel der Aetiologie und Definition der pathologischen Prognathie bringen, ich unterlasse es an dieser Stelle, weil sie den Sternfeld'schen Ausführungen nichts wesentlich Neues hingzufügen würden.

Wir können nur immer wieder constatiren, dass unter dem Eindruck der Wichtigkeit der Art des Zusammentreffens beider Zahnreihen die einzelnen Abschnitte des Kieferprofils in ihrem gegenseitigen Verhältnis und ihrer eventuellen gegenseitigen Beeinflussung wenig oder keine Berücksichtigung gefunden haben und dass man auf die Annahme einer fixen Linie, von der aus die einzelnen in Betracht kommenden Teile leicht zueinander in Beziehung zu bringen wären, verzichtet hat.

Auch die Wachstumsverhältnisse der Schädelbasis werden kaum zu übergehen sein, da sie, wie erwiesen, in Beziehung stehen zur Form und Stellung der Kiefer und zur Gestaltung des Gaumens. Leider aber sind die an Lebenden häufig genug zu beobachtenden pathologisch-prognathen Formen nicht direct nach dieser Richtung hin nachzuprüfen; todtes Material aber stand mir leider in dem Umfange zur Verfügung, dass sich eine diesbezügliche Untersuchung verlohnt hätte.

Da ist nicht nur im Sinne des Craniologen gesprochen, dem es darauf ankommt, wichtige Merkmale für die verschiedenen Formen der Prognathie festzulegen, sondern auch im Interesse des zahnärztlichen Orthopäden, der sein Hauptaugenmerk auf die Herstellung ästhetischer Gesichtslinien richtet.

Verschiedene Ziele schliessen ein gemeinsames Arbeitsfeld und mannigfache Berührungspunkte auf demseben nicht aus. Wenn das gefallende Schöne dem Orthopäden als erstrebenswertes Ziel gilt, wird es dem Craniologen den Maasstab führen bei der Festlegung der Grenze zwischen normal und anormal.

Beide stehen unter dem Einfluss des Gesichtsausdruckes, der Gesamtwirkung aller Teile und Dimensionen des menschlichen Antlitzes.

Stehen diese im Verhältnis gegenseitiger Maassgleichheit zueinander so wird man das Gesicht nicht nur normal, sondern auch schön und edel finden, es wird demjenigen des Idealmenschen entsprechen oder doch nahe kommen. Ist aber die gegenseitige Maassgleichheit gestört, so dass ein oder mehrere Teile des Gesichtes zu Ungunsten des anderen sich vordrängen, so ist das abnorm und zugleich hässlich.

Das beherrschende Charakteristicum im menschlichen Antlitz ist das Profil, ihm sind alle anderen Züge untergeordnet, indem sie darnach streben, mit ihm zu harmoniren. Die Contouren des Pro-

fils wurden nicht nur dem Anthropologen der Ausgangspunkt seiner Bestrebungen, Rassenunterschiede zu begründen, sondern bildeten von jeher auch für den Künstler die Grundlage der Schönheitsbestimmung des menschlichen Antlitzes.

Der Anthropologe aber war zuerst mehr Künstler als nüchterner Wissenschaftler bei der Beurteilung der Gesichtsformen.

Die Vereinigung vergleichend anatomischer und anthropologischer Gesichtspunkte mit solchen, die sich auf die Beurteilung des gafallenden Schönen beziehen, spricht sich deutlich in dem ältesten Maasse aus, das auf den Schädel Anwendung fand, in dem Gesichtswinkel Peter Camper's namlich (1722-1840).

Aufmerksam geworden auf die verschiedene Neigung, die das Profil des Schädels bei Mensch und Tier und bei den verschiedenen menschlichen Rassen aufweist, suchte er, wie ich bereits im ersten Teile meiner Arbeit auseinander gesetzt habe, diese Neigung durch einen Winkel graduell zu bestimmen, der durch zwei Linien gegeben ist, durch eine horizontale vom Gehörgange längs dem unteren Teile der Nase verlaufende und eine zweite, die vom hervortretenden Teile der Stirn in der Medianlinie zur Vorderfläche des Oberkiefer-Alveolarfortsatzes geht. Am Lebenden ist nach Camper's Angabe das Profil durch die Stirn und die Oberlippe bestimmt.

Die Vergleichung des Gesichtes eines Weissen mit dem eines Schwarzen ist besonders instructiv.

Nach Messung zahlloser Objecte fand Camper in der Grösse dieses Winkels den Maassstab für den edleren Gesichtsausdruck.

Thatsächlich zeigen die niederen Rassen einen offenbar kleineren Camper'schen Winkel als die Kulturvölker.

Das Hervortreten und die stärkere Wölbung der Stirn verbunden mit dem Orthognathismus galt und gilt auch heute noch als Zeichen höherer Intelligenz, die zurücktretende Stirn dagegen mit mehr oder weniger starkem Prognathismus vergesellschaftet, entspricht, unserem Empfinden nach einer niederen Entwicklungsstufe, einer Annäherung an das Tierische.

In diesem Zusammenhang verdient die Thatsache Erwähnung, dass griechische wie römische Götter- und Heroenstatuen einen übermässig grossen, einen rechten übertreffenden Camper'schen Winkel aufweisen. Die Alten hatten, wie Klaatsch treffend bemerkt, gleichsam instiktiv ein anthropologisches Maass benutzt, um die Erhabenkeit und geistige Ueberlegenheit ihrer Götter und Helden auszudrücken.

Wenn ich im folgenden näher auf die ästhetischen Verhältnisse der Hauptzüge des menschlichen Gesichtes eingehe, so mag man daraus ersehen dass ich nicht lediglich ihrer selbst wegen die pathologische Prognathie studiren möchte, sondern hauptsächlich auch rücksichtlich ihrer orthopädischen Behandlung.

Eine Würdigung der Principien der Kunst bringt, meine ich, nach zwei Richtungen hin Vorteile, erstens wird sie den anatomischen Eigenschaften der einzelnen Formen der pathologischen Prognathie mehr Charakter verleihen, zum andern wird sie die durch orthopädische Maassnahmen angestrebten Erfolge sicherer und erfreulicher gestalten.

Bei der Beurteilung der Schönheit des menschlichen Antlitzes ist uns neben der verschiedenen Neigung, die das Profil aufweist, auch das dimensionelle Verhältnis der einzelnen Gesichtsabschnitte besonders maassgebend.

Fraglos steht dieses vielfach in Beziehung zur Grösse des Gesichtswinkels, kann aber auch ebenso von diesem unabhängig sein, jedenfalls ist es ein selbstständiges Schönheitsmoment, das für sich zu studiren ist.

Das griechische Profil, das im wesentlichen durch einen sehr grossen Gesichtswinkel und dadurch charakterisirt ist, dass die Stirn sich in gerader Linie in den Nasenrücken fortsetzt, kann ich nur dann wirklich schön finden, wenn die einzelnen Gesichtsabschnitte auch dimensionell gleichmässig entwickelt sind.

Das Entscheidende liegt hier darin, dass die Längsachse des Gesichtes in drei gleiche Teile zerfällt, nämlich vom Stirnwinkel bis zum oberen Augenrand, von da bis zum unteren Nasenrand, von da bis zum Kinn.

Wird dieses Verhaltniss gestört, so kann selbst ein griechisches Profil nicht mehr als vollendet schön gelten.

Lehrreich sind in dieser Beziehung manche hocharchäischen Monumente, sie zeigen eine andere Art der Dreiteilung des Gesichtes, aus der ein lang ausgezogenes Untergesicht resultirt, das den Gesichtsausdruck entschieden ungünstig beeinflusst.

Hier liegt das Entscheidende darin, dass die Entfernung Auge bis Kinn durch die Linie der Mundspalte in zwei gleiche Teile verlegt ist.

Nicht so störend wirkt eine Mässige Verschiebung der Stirn- zur Nasenlinie im Sinne der Verkleinerung des Profilwinkels.

Das Typische des g r i e c h i s c h e n Schnittes, das Zusammenfallen der Stirn- und Nasenlinie, kann fehlen, ohne die Schönheit des Antlitzes zu beeinträchtigen.

Immerhin aber kann das griechische Profil, Maassgleichheit der einzelnen Gesichtsabschnitte vorausgesetzt, als vollendet schöne Gesichtsbildung gelten, die nicht nur in der Phantasie des Künstlers sondern auch in der Natur existirt.

"Der antike Schnitt," sagt Brücke, "wird von vielen als ein Ideal angesehen, das man heutzutage nicht mehr findet, und das vielleicht überhaupt niemals zu finden war; aber dem aufmerksamen Beobachter wird es nicht entgehen, dass man in Italien und selbst in Deutschland zuweilen Köpfe findet, die sich diesem Ideale in hohem Grade nähern."

Das beweist auch Stratz durch die Wiedergabe einer Reihe trefflicher Charagterköpfe mit rein grichischem Profil. Immerhin ist dieser nur sehr selten zu finden.

Wohl erinnern viele hübsche Profile in ihrer unteren Hälfte lebhaft an den idealen antiken schnitt, in ihrer oberen Hälfte aber weichen sie bedeutend ab: Stirn und Nase liegen in mehr oder minder grossem Winkel zueinander, was, wie bereits gesagt, die Schönheit nicht wesentlich schädigt.

Dagegen sind Nase, Mund und Kinn sehr empfinliche Schönheitsfactoren, selbst die kleinsten über das Maas hinausgehenden Veränderungen dieser Teile können die Schönheit des Antlitzes herabsetzen oder auch ganz zerstören.

Sie aber sind in ihrer Gestaltung im wesentlichen abhängig von der Entwicklung der Kiefer, speciell des Oberkiefers, der wiederum in Form und Lagerung unmittelbar durch die Funkton des Gebisses ausserordentlich beeinflusst werden kann, wie ich das im ersten Teile meiner Arbeit nachgewiesen zu haben glaube.

Dieser Zusammenhang befähigt insbesondere den Zahnarzt, Gesichts orthopäde zu sein.

Thatsächlich entspricht gerade der Abschnitt des Antlitzes, der aus Schön-

heitsrücksickten häufig genug einer Umgestaltung durch orthopädische Maassnahmen bedarf. jener Region, die ihre charakterissische Gestalt durch die Entwicklung und Function der Zähne und Kiefer erhält und die daher auch durch die die Zähne angreifende orthopädische Apparate zu verändern möglich ist.

Das durch die Zähne beeinflusste Gebiet erstreckt sich vom Naso-frontalpunkt bis zum unteren Rande des Kinnes, die Nasenflügel, beträchtliche Teile der Wangen, das gesamte Kinn und den grössten Teil des lateralen unteren Gesichtsrandes einschliessend.

Wie weit die Kieferform, speciell die des Oberkiefers, die Gesichtsbildung beherrscht, lehrt am besten neben dem rein anatomischen Befund ein Rückblick auf die embryonale und spätere Entwicklung derselben.

Beide Oberkieferbeine bilden die knöcherne Grundlage der oberen Gesichtspartie, sie sind an der Bildung der Augenhöhlen, der Nasenhöhle und des Jochbogens beteiligt; beherrschen durch den Processus frontalis den Uebergang zur Stirn, geben der oberer Mundpartie ihren individuellen Ausdruck und stellen durch den Processus alveolaris die Verbindung her mit dem Unterkeifer, der Stütze des unteren beweglichen Abschnittes des Gesichtes, der in Form und Lagerung auch nicht unbeeinflusst von ihnen bleibt.

Entwicklungsgeschichtlich spielt der Oberkiefer unter den Gesichtsknocken eine führende, beherrschende Rolle, wie das aus der Vergleichung eines embryonalen Schädels mit dem eines Neugeborenen ersichtlich wird.

Die urspriinglichen, ziemlich gleichmässig gross angelegten Gesichtsfortsätze (mittlerer, seitlicher Nasenfortsatz, Oberkiefer- und Unterkieferfortsatz), die in der Anlage Haut, Muskeln, Blutgefässe, Nerven und die Knochen des zukünftigen Gesichtes enthalten, variiren zur Zeit der Geburt schon beträchtlich an Umfang und Gestaltungsvermögen.

Die den drei Nasenfortsätzen angehörigen Knochen, die Nasenbeine und der Zwischenkiefer, sind im Wachstum vom Oberkiefer bereits weit überholt, der auch für die Folgezeit der Mittelpunkt für die Gestaltung des Gesichtes bleibt und den Ausdruck desselben bis ins Greisenalter beherrscht. Er ist, wie die Vergleichung dreier Altersstufen lehrt, unter dem Einfluss der Zahnentwicklung und der Function des Gebisses namentlich für die Höhe und die Länge des Gesichtes maassgebend.

Auch für die Breite des Antlitzes kommt in Betracht, wenngleich diese der Hauptsache nach durch die grössere oder geringere Ausbildung der Jochbeine beeinflusst wird.

In ähnlicher, wenn auch nicht in so ausgedehnter Weise wirkt der Unterkiefer in seinen den verschiedenen Altersstufen entsprechenden Formen auf die Bildung und den Ausdruck des Gesichtes.

Schon der Durchbruch der Milchzähne, der die erste wesentliche Grössenzunahme beider Kiefer veranlasst, lässt das Säuglingsantlitz länger erscheinen, und giebt ihm mehr eigenart durch die Zunahme der Höhe der Mundregion, die nach erfolgtem Durchbruch der Milchzähne, also nach vollendetem zweiten Jahre, der Nasenregion an Länge nichts mehr nachgiebt.

Das Gesichtskelett des Kindes Unterscheidet sich also bezüglich der genennten Porportionen in der Weise von dem Erwachsenen, dass bis gegen das zweite Lebensjahr hin die Nasenregion die längere ist. In unvergleichlich stärkerem Maasse nimmt die Gesichthöhe zu unter dem Einfluss der zweiten Dention: die

Züge sind länger, bestimmter und kräftiger ausgeprägt. Jetzt tritt auch der Unterkiefer mächtiger hervor, durch den kleineren Unterkieferwinkel wird das Gesicht besser und schärfer abgegrenzt, der Mund verliert die rundliche, weiche Gestalt und wird mehr in die Länge gezogen, während die Nase durch die Abflachung der Wange mehr hervortritt.

Mit dem Verluste der Zähne nimmt die Höhe der Kiefer und dementsprechend auch die Gesichtshöhe ab; die Alveolen sind verschwunden, der Oberkiefer bedeutend verkürzt wird nunmehr vom Unterkiefer überragt.

Das ganze Gesicht fällt in der Richtung des Oberkiefer-Alveolarrandes ein und bietet den senilen Gesichtstypus dar.

Aber auch innerhalb derseben Altersstufe ergeben sich aus vielfachen individuellen Verschiedenheiten der Entwicklung und Form der Kiefer zahlreiche Verschiedenheiten der Gesichtsbildung.

Eine im ganzen sehmale Entwicklung der Kiefer begünstigt die Gesichthöhe, eine breitere Gestaltung druckt sie herab. Starke Stirnfortsätze des Oberkiefers schaffen eine breite Nasenwurzel, eine mächtige Entwicklung des Kieferkörpers bringt die Jochbogen nach aussen und die Nase nach vorn.

Der untere Teil des Oberkiefers kommt für die Bildung der Oberlippe in Betracht. Mehr oder minder senkrecht oder schräg gerichtet wirkt er nicht allein bestimmend auf die Höhe des Gesichtes, sondern auch auf die Grösse des Profilwinkels ein.

Tritt der Oberkiefer in schräger Richtung nach vorn heraus, so ist damit häufig eine Verkürzung und Verbreiterung der Nasengegend verbunden so dass die Nasenspitze nach oben abgelenkt wird und die Nasenlöcher nach vorne hin sichtbar sind.

Daneben findet sich gewöhnlich eine breite Entwicklung des Unterkiefers.

Eine grössere Gesichtshöhe dagegen wird erreicht, wenn die unteren Partien des Oberkiefers schmal sind. Dadurch tritt erstens die Mundpartie weiter zurück, zweitens wird der Nasenabschnitt schmäler und länger.

In seiner Wirkungsweise wird der Oberkiefer vom Unterkiefer in den meisten Fällen unterstützt. Ein schmal entwickelter Unterkiefer gehört dem langen, ein breit entwickelter gewöhnlich dem niedrigen Gesicht an.

Ausser der Form der Kinnlage ist auch die Grösse ihres Winkels für die Profilsilhouette von Wichtigkeit, da der Unterkiefer nach hinten und unten die Umrisse des Profils bestimmt.

Aus der Variabilität der einzelnen Gesichtabschnitte resultirt, wie Dürer,* in genialer Weise darzustellen verstanden hat, die Verschiedenheit der Physiognomie.

Dadurch, dass der Künstler die einzelnen Abschnitte länger und kürzer werden liess, construirte er scharf individualisirte Gesichtsbilder.

Dieser Wechsel in den Proportionen, der den Reiz der Individualität erzeugt und deshalb für jeden Künstler Gegenstand eifrigen Studiums bildet, hat bereits lange vor Dürer im Sinne der Schönheitsbestimmung des menschlichen Antlitzes Beachtung gefunden.

Schon zur Zeit der alten Egypter sind künstlerisch veranlagte Männer bemüht gewesen, die Gesetzmässigkeit der Proportionen des menschlichen Körpers zu erforschen.

Sichere Daten aber finden sich erst bei Vitruv, der sich besonders eingehend

* Opera Alberti Dureri, etc. zu Arnhem 1603.

mit den Proportionen des Gesichtes beschäftigt hat. Er beschreibt das Gesicht als *os capitis a mento ad frontem summam et radicis imas capilli.* Gesicht ist hier also im gewöhnlichen Sinne verstanden vom Kinnpunkt bis zur Haargrenze.

Das Gesicht selbst teilt Vitruv in drei Teile: *Ipsius autem altitudinis tertia est pars ab imo mento ad imas nares, nasum ab imis naribus ad finem medium superciliorum tantundem, ab ea fine ad imas radices capilli frons efficitur item tertiae partis.*

Damit ist scharf ausgedrückt Stirn, Nase, Untergesicht.

Ausser den geringen Andeutungen Vitruvs ist nichts aus dem Altertum erhalten, was uns über thatsächlich beobachtete Zahlenverhältnisse im Gesicht aufklären könnte.

Erst als mit der Renaissance das Interesse am menschlichen Körper wieder erwachte, wurde die Verhältnismässigkeit des Gesichtes und seiner Teile Gegenstand eifriger Erörterung.

Neben Albrecht Dürer steht Leonardo da Vinci;* beide gehen hinsichtlich der Proportionen des Gesichtes von Vitruvs Dreiteilung aus. Ich will nicht näher auf ihre Teorien eingehen, für uns ist es wichtig zu wissen, dass sowohl nach Leonardo's wie nach Dürer's Teilung die Entfernung von Mundspalte bis Kinn sich zu derjenigen von mundspalte bis Haarwurzel wie 1 : 3 verhält.

Von anderen Teorien erwähne ich noch die Schadow's.†

Er fasst als Gesicht nur den Raum vom oberen Rande der Augenhöhle bis zum unteren Rande des Kinnes und teilt diesen in sechs gleiche Teile:

1. Teil—Augenrand bis Augenwinkel.
2. Teile—Augenwinkel bis Nase.
1. Teil—Nase bis Mundschlitz.
2. Teile—Mundschlitz bis Kinn.

Das führt zu folgenden Gleichungen: Untergesicht d. h. unterer Rand der Nüstern bis Kinn-Nase bis Augenrand—Augenwinkel bis Mundschlitz; Augenwinkel bis Nase—Mundschlitz bis Kinn; Augenwinkel bis Augenrand—Nase bis Mundschlitz.

Ausserdem ergeben sich folgende Verhältniszahlen: Augenwinkel bis Kinn: Augenwinkel bis Nase: Augenwinkel bis Mundschlitz=5 : 2 : 3.

Sehen wir ab von dem oberen Augenrand und setzen für den inneren Augenwinkel den Nasofrontalpunkt, so würde das Gebiet der Proportionen der Einflussspähre der Kieferentwicklung und dem Arbeitsgebiet des Orthopäden entsprechen. Insofern könnte Schadow's Aufstellung uns am meisten interessiren. Nehmen wir als Grenze des oberen Gesichtes den Nasofrontalpunkt an, so ist die Länge der Mundregion, von einzelnen Ausnahmen abgesehen, stets grösser als die des Obergesichtes (Nasenregion). Diese Differenz aber wird am kurzen Gesichtsskelett geringer demnach ist für die Verhältnismässigkeit des langen Gesichtes eine besondere Höhe der Mundregion charakteristisch.

Wie sind die einzelnen Abschnitte bezüglich ihrer Höhe zu messen?

Eine directe Messung derselben ist wie die Erfahrung lehrt nicht angängig, man hat vielmehr alle Distancen auf eine Senkrechte zu übertragen oder auch auf eine Gerade, die mit der Langsachse des Kopfes parallel verläuft, da die Abweichungen der directen Entfernung von der übertragenen relativen Höhe sehr oft beträchtlich sind.

Wenn Bride den sich mit Gesicht-

* Literary Work of Leonardo da Vinci. By F. P. Richter, Vol. I.

† Polyclet oder von den Maassen des Menschen. Berlin, 1886.

orthopädie beschäftigenden Zahnärzten vorschlägt, die "Linie der Harmonie," eine Gerade, die vom hervorragendsten Punkte der Prominentia frontalis zum hervorragendsten Punkte der Prominentia mentalis zieht zur Diagnose von Unvollkommenheiten in der Gesichtsbildung heranzuziehen, so hat er bestimmt weniger das Länger resp. Höhenverhältnis der einzelnen Gesichtsabschnitte dabei im Auge gehabt, als ihre mehr oder minder starke Neigung hervor- oder zurückzutreten.

Diese Linie als Grundlage für die Beurteilung prognather Grade zu wählen, ist schon deswegen nicht angängig, weil sie nicht durch neutral Punkte bestimmt wird. Mehr zu empfehlen wäre eine Linie, die parallel mit der Längsachse des Kopfes verläuft.

Mir scheint jedoch besonders das Camper'sche Verfahren, das übrigens bei Ausschaltung der Stirn auf den Nasofrontalpunkt als obere Gesichtsgrenze leicht anwendbar ist, besondersgeeignet, zur Charakterisirung auch pathologisch-prognather Formen beitragen zu können.

Ich möchte jedoch hierzu ausdrücklich bemerken, dass die Ergebnisse einer Messung allein niemals ausreichen können, die einzelnen Arten pathologischer Prognathie von einander abzugrenzen, es giebt eine grosse Reihe von Eigentümlichkeiten, die für diese oder jene Art charakteristisch und leicht wieder zu erkennen sind, die aber mit einem Maasssystem überhaupt nicht in Beziehung gebracht werden können.

Um die Eigenheiten leichter zu finden und sicherer zu fixiren wird es vorteilhaft sein, die Orthognathie und die physiologische Prognathie zum Vergleiche möglichst oft heranzuziehen.

Naturlich sind viele kleine Besonderheiten der Form schwer zu isoliren und zu klassificiren, so dass sie symptomatischen Wert haben könnten; ich gebe auch gern zu, dass der Formenreichtum prognather Bildungen bei dem Umfange des mir zu Gebote stehenden Materials anfänglich verwirrend auf mich wirkte, dass ich erst eine bessere Uebersicht gewann, als sich mir die Möglichkeit zeigte, sämtliche prognath erscheinenden Formen der Hauptsache nach in zwei Gruppen unterzubringen. Es handelt sich um absolute oder um relative Prognathismen. Natürlich finden sich auch hier viele Uebergangs- und Combinationsformen.

Die absolute Prognathie ist gekennzeichnet durch einen über dass orthognathe Maass hinausgehenden, also unnormal kleinen Gesichtswinkel, der durch abnorme Wachstums-oder Lagerungsverhältnisse des Oberkiefers, manchmal auch beider Kiefer bedingt ist, während die relative Prognathie einen vollkommen orthognathen Gesichtswinkel einschliessen kann, da sie aus einer mangelhaften Entwicklung des Unterkiefers bei normal gebildetem und orthognath gelagertem Oberkiefer resultirt.

Im Form und Wesen steht die absolute pathologische Prognathie der physiologischen näher als der relativen.

Das Verhältnis der Kiefer zu dem übrigen Gesicht ergiebt sich bei der Messung des Gesichtswinkels, den ich durch zwei Linien-die eine verläuft vom Gehörgange längs dem unteren Teil der Nase, die andere streift den Nasofrontalpunkt und den unteren Rand der Oberlippebestimme, kein wesentlicher Unterschied; 68° beträgt der Gesichtswinkel des Negers, 70° der des 14 jährigen Europäers. Ebenso ist in beiden Fällen das Verhältnis der Länge der Mund- zur Nasenregion annähernd dasselbe, die Mundpartie erscheint abnorm lang.

Uebertragen wir die Entfernungen auf eine zur Horizontalen senkrecht verlaufende Gerade, so verhält sich beim Neger die Höhe der Mundregion* zur Höhe des Nasenregion in Millimetern wie 20 : 10. Normaliter sollte sich indessen die Mund zur Nasenregion wie 3 : 2 verhalten.

Trotzdem aber ergaben sich doch mancherlei Abweichungen, die in der Form und Stellung der Kiefer, in der Gestaltung des Gaumens, der Zahnreihen, der Zähne selbst und nicht zuletzt in der Art der Articulation beider Zahnreihen zu suchen ist. Ich werde diese Verhältnisse bei der Besprechung der einzelnen Sonderformen näher erörtern. Doch will ich gleich noch darauf aufmerksam machen, dass bei der physiologischen Prognathie das Mittelgesicht durch die starke Abplattung der Nase stark eingedrückt erscheint, dass sowohl Nasen- wie Mundregion im Verhältnis zur Gesichtlänge breiter ist, als bei jeder pathologischer Form.

Ausserdam ist die physiologische Prognathie stets dadurch charackterisirt, dass der Oberkiefer nicht auf wagerechter Ebene, wie es bei vielen Formen pathologischer Prognathie der Fall ist, nach vorn verschoben erscheint, sondern im Bogen nach vorn und oben; daraus erklärt sich auch, das selbst stark prognathe Negerschädel einen verhältnismässig grossen Mittelgesichtswinkel aufweisen, dass ferner, wie ich beobachten konnte, der Winkel den die flügelartigen Fortsätze mit der Schädelbasis bildet, bei der physiologischen Prognathie verhältnismässig grösser ist, als bei pathologischen Formen.

* Ich mache Gebrauch von der Schadow'-schen Einteilung und rechne die Mundregion vom Kinn bis zum unteren Rand der Nüstern, die Nasenregion von hier bis zum Nasofrontalpunkt.

Hierfür kommen selbstverständlich nur die pathologischen Prognathismen in Betracht, die als maxillare zu bezeichnen sind, während alveoläre und alveolodentale Formen mit den Wachstumsverhältnissen der Schädelbasis schwerlich in Beziehung zu bringen sind. Wie weit überhaupt die Gestaltung der Schädelbasis die Gesichtsentwicklung beeinflusst, ist schwer zu sagen. Es bestehen die verschiedensten Ansichten von der Correlation zwischen Schädel- und Gesichtsentwicklung, das eine aber wird immer zugegeben werden müssen, dass, wenn auch die in Rede stehenden Teile stets in gleicher Weise mit einander verbunden sind, ihre Bildungsenergie nicht in allen Fällen dieselbe sein kann, und dass eine Störung in der Gestaltung des einen Factors nicht unbedingt eine bestimmte Veränderung in der Formung des anderen nach sich ziehen muss.

Der Gesichtswinkel im Sinne eben beschriebener Bestimmung entspricht meiner Beobachtung nach unter 80° bereits absolut prognather Formation, mit 80 und höheren Graden ergeben sich orthognathe Profile.

Mannigfach nicht nur dem Grade sondern auch der Gestaltung nach ist das Bild der absoluten pathologischen Prognathie. Sie kann als Mittelgesichtsprognathie bestehen, ohne auf den Alveolartheil und die Zähne überzugreifen. In solchen Fällen ist der ganze Körper des Oberkiefers vorgelagert (Maxillare Prognathie), was hauptsächlich durch den stark vorspringenden Subnasalpunkt gekennzeichnet ist, der von den orthognath gelagerten Zähnen und selbst auch von der Oberlippe kaum überholt wird.

Der Unterkiefer folgt dem weit vorgelagerten Oberkiefer, so dass ein normales Articulationsverhältnis der Zahnreihen zu Stande kommt. Die dimen-

sionellen Verhältnisse der einzelnen Gesichtsabschnitte habe ich bereits erörtert. Die Zahnbögen sind gleichmässig gut geformt, der Gaumen ist normal hoch und weit gebildet. Dafür aber ist der Unterkieferwinkel abnorm stumpf, wodurch die untere seitliche Gesichtsgrenze stark verlängert erscheint.

Die abnorme Grösse des Unterkieferwinkels scheint mir nicht unwesentlich, sie resultirt, meine ich, aus den Bestrebungen des Unterkiefers, den von vornherein weit vorgelagerten Oberkiefer einzuholen um eine normale Articulation zu gewinnen.

Diese Art der Prognathie kann offenbar niemals durch rein mechanische während des Zahnwechsels bestehende Verhältnisse erzeugt werden, hier müssen hereditäre Einflüsse eine grosse Rolle spielen.

Mir war es interessant, diese Form als Familieneigentümlichkeit mehrfach beoachten zu können.

Die eben beschreibene prognathe Bildung hat nicht die Tendenz höher werdende Grade anzunehmen, sie ist beständig und sichert dem Gebiss dauernd eine zweckmässige Function.

Der physiognomische Ausdruck ist dagegen kein angenehmer. Die fliehende Stirn, die platte Nase, das zurückweichende Kinn und das gleichmässig starke Vortreten beider Kiefer sind dem Ausdruck hoher Intelligenz nicht günstig und erinnern lebhaft an die Negerphysiognomie, wenn auch der classische Negertypus nicht denselben prognathen Verhältnissen entspricht.

Wohl ist an seinem Prognathismus das Mittelgesicht beseitigt-wie bei der in Rede stehenden pathologischen Bildung, wirklich charakteristisch und bedeutend ist er aber nur in der Subnasalparthie. Demgemäss ist auch das Articulationsverhältnis insbesondere der Frontzähne verschieden geartet.

Während bei der physiologischen Prognathie die Frontzähne mit ihren Schneiden schräg aufeinandertreffen, übergreifen bei der eben beschriebenen pathologischen Form die oberen in ihrer ganzen Länge orthognath gerichteten Vorderzähne ihre ebenfalls senkrecht im Kiefer stehenden, manchmal sogar invertirten Antagonisten bis zur Hälfte der Krone.

Dem "flachen Biss" im Bereiche der Frontzähne, der der physiologischen Prognathie eigentümlich ist und der ausgiebige Kaubewegungen ermöglicht, entspricht ein "flacher Biss" im Bereiche der Backenzähne. Die oberen erscheinen den unteren mehr aufgelagert zu sein, die Höcker sind niedrig entwickelt und gehen schon in mittlerem Alter durch Abrasion verloren.

Umgekehrt finden wir bei den pathologischen Formen dem Uebereinandergreifen der Frontzähne entsprechend hohe, nicht besonders kräftig entwickelte Höcker der Seitenzähne, die fraglos die Seitenbewegungen des Unterkiefers einschränken.

Neben der Art des Zusammentreffens der Frontzähne verdient auch ihre Form Berücksichtigung bei der Beurteilung prognather Bildungen.

Ich habe mich davon überzeugt, dass man mit Recht die Formen der Frontzähne nicht allein zur Gestaltung der Seitenzähne sondern auch zur Bissart und Kieferform in Beziehung bringen kann. Ich möchte auch diese Verhältnisse kurz besprechen, selbst auf die Gefahr hin, von meinem Thema abzulenken.

Das Studium der Formenschwankungen der Zähne ist noch sehr unvollommen; hier sind die Arbeiten von Zuckerkandl, Azoulay und Regnault einschlägig. Während Zuckerkandl vorzüg-

lich die Formation der menschlichen Mahlzähne behandelt, haben Azoulay und Regnault über die Form der oberen mittleren Schneidezähne Studien angestellt, Studien, die besonders die Wissenschaft der ethnologischen Zahnkunde zu födern im Stande sind.

Wenn man neben der Grösse und der Stellung der Zähne auch ihre Form zur Rassenfrage in Beziehung zu bringen sucht, so nimmt man von vornherein an, dass die verschiedenen Rassen als solche Verschiedenheiten der Zähne aufweisen, die einen positiv diagnostischen Wert haben.

Inwieweit diese Annahme berechtigt ist, wird man erst dann beurteilen können, wenn der grosse Mangel an Material für die wissenschaftliche Betrachtung der Ethnologie der Zähne überwunden sein wird.

Was es besonders schwierig macht, aus den mancherlei Besonderheiten der Form wirklich durchgreifende Merkmale zu isoliren, ist die Thatsache, dass die ganze Reihe der möglichen Variationen der einzelnen Zähne schon in den Individuen einer Rasse verhanden zu sein scheint.

Besonders die modernen europäischen Rassen zeigen viele Verschiedenheiten, die den schnellen Wechseln der Lebensbedingen entsprechen, mit denen der cultivirte Mensch sich selbst umgiebt.

Es unterliegt keinem Zweifel, dass die Variationen der Zahnform gleichen Schritt halten mit der Degeneration des Gebisses, denn gehen wir abwärts in der Entwicklungsscala, so finden wir die Gestalt der Zähne beständiger und infolge dessen von grösserem symtomatischen Wert. Aber auch bei den Naturmenschen sind die anatomischen Formen nicht beständig genug, die für die Rasse oder den Stamm typische Zahnform ohne Weiteres erkennen zu lassen.

Bei den Anthropoiden findet man eine bei weitem grössere Beständigkeit der reinen anatomischen Formen, wenn auch da schon gelegentlich Degenerationserscheinungen an den Zähnen vorkommen.

Diese Ausführungen schliessen zunächst ab mit der für uns wichtigen Thatsache, dass die Zähne der niederen Rassen in Form und Grösse den Zähnen der Anthropoiden bedeutend näher stehen, als die der höheren Rassen.

Ein vergleichendes Studium der Zahnformen der Anthropoiden und des Menschen auf den verschiedenen Stufen seiner Stammesgeschichte lässt jedenfalls einen Schluss zu auf den ursprünglichen Typus der Zähne und lehrt uns zugleich, in welcher Weise sich die Degeneration derselben vollzieht.

Ziehen wir nun noch die als unnormal und pathologisch geltenden Zahnformen zu vergleichender Betrachtung heran, so werden wir finden, dass sie den modernen Zahnformen des Culturmenschen am nächsten stehen und vielfach nur einem graduellen Fortschritt in der Degeneration entsprechen.

Einer rüchwärts gehenden Entwicklung der Zähne entspricht naturgemäss eine solche der Kiefer, die unter denselben oder doch ganz ähnlichen Bedingungen die Wechsel der Lebensweise zu überstehen und sich ihnen anzupassen haben. Der physiologisch prognathe Charakter hat sich bedeutend vermindert und gleichzeitig hat eine entsprechende Verminderung der Gesamtlänge des harten Gaumens stattgefunden.

Daraus resultiren nun wieder zwei oder drei Folgeerscheinungen: entweder der Alveolarbogen wird verkürzt und infolge dessen hat der Zahnbogen eine geringere Ausdehnung oder der Alveolarfortsatz behält seine absolute Länge, während der harte Gaumen an Breite entsprechend zunimmt.

Besonders beachtenswert ist die Höhe des Gaumengewölbes, die nach den Untersuchungen Talbots, der von zahlreichen Mitarbeiten unterstützt über ein ungeheures Material verfügte, mit der geringeren Culturstufe abnimmt.

Bei den uncivilisirten Völkern herrscht der flache Gaumen vor bei kräftiger Entwicklung der Kiefer, während andererseits die Völker, die culturell und geistig höher stehen, schwach entwickelte Kiefer und hohe Gaumen aufweisen. Eine hohe Stirn und der Orthognathismus begleiten (normale Verhältnisse vorausgesetz) gewöhnlich den hohen Gaumen, während eine flachere Gestaltung desselben in der Regel zussammenfällt mit einer niedrigen Stirn. Ausnahmen finden sich selbstverstandlich auch hier. Fraglos ist der hohe und schmale Gaumen als ein Zeichen degenerativer Entwicklung anzusehen, er findet sich auffallend häufig bei schwächlichen, nervözen, dabei jedoch gut begabten Kindern, andererseits ist eine hohe spitzbogenförmige Gaumenwölbung ein charakteristisches somatisehes Merkmal des Idiotismus.

Soweit ich ferner beobachtet habe, ist der flache Gaumen allen jenen Bissarten eigentümlich, die wir als die ursprünglicheren und functionsfähigeren anzusehen haben, also vor allem den physiologisch prognathen und dem geraden Biss, während der hohe Gaumen bei den weniger functionskräftigen Bissarten, mögen sie als normal oder pathologisch gelten, vorherrscht; so besonders bei den übergreifenden und pathologisch prognathen Bissarten.

Ich will diese Verhältnisse hier nicht weiter erörtern, das Gesagte möge dazu beitragen, es berechtigt erscheinen zu lassen, auch im Interesse des von mir behandelten Themas Zahnform, Bissart, Gestaltung des Kiefers und des Gaumens in Beziehung zu einander zu bringen.

Die ganze Scala der möglichen Variationen der Frontzähne lässt sich auf die Grundformen beziehen, die ich nebenbei schematisch dargestellt habe.

Im Allgemeinen aber können wir doch die Ansicht vertreten, dass bei den menschenähnlichen Affen stets die Seitenränder der Schneidezähne von der Wurzel gegen das freie Ende hin divergiren, so dass der Zahn ein dreieckiges Aussehen bekommt mit sehr breiter Schneide, dass bei den niederen Menschenrassen sich dieselbe Anordnung findet, jedoch weniger ausgeprägt. Diese Formation gestaltet das nachbarliche Verhältnis der Zahnkronen derartig, dass sie sich nur in der Höhe ihres freien Randes berühren, im übrigen aber durch einen V förmigen Raum von einander getrennt sind, der grösstenteils durch eine mächtig entwickelte Zahnfleischpapille ausgefüllt ist.

Dagegen zeigen bei den civilisirten Rassen die Seitenränder der Kronen die Neigung, parallel zu werden, sodass diese eine rechteckige Gestalt annehmen. Vielfach sind so geformte Zähne dünn und schmal, eher lang als kurz.

Die dem dritten Typus angehörenden Schneidezahnformen sind dadurch charakteristisch, dass in Folge der Abrundung der Ecken die Länge der Schneide dem kleinsten Durchmesser der Krone entspricht. Hier giebt es eine ganze Reihe von Variationen.

Zähne dieser Art sind in der Regel auffallend klein und tragen häufig die Zeichen mangelhafter Structur an sich.

Wir gehen nicht fehl in der Annahme, dass die dem ursprunglichen Typus nahekommenden Formen der Frontzähne solchen der Seitenzähne entsprechen, die ausgiebige und functionskräftige Kaube-

wegungen zulassen. Kräftige, verhältnismässig kurze, auf starken Wurzeln ruhende Kronen, die breite und niedrige Höcker und eine möglichst grosse Kaufläche bezitzen, indem sie nach dem Zahnhals hin verjüngen, erfüllen ihren Zweek am besten.

Den zweiten Typus der Frontzahnform entsprechen vielfach verhältnismässig hohe Kronen der Backenzähne mit parallel verlaufenden Seitenflächen, weniger kräftig ausgebildeten Wurzeln und hohen spitzen Höckern, eine Formation, die die Seitenbewegungen des Unterkiefers erheblich einschränken kann.

Unregelmässige Höekerbildung und verkümmerte Kauflächen weisen häufig die Seitenzähne auf. Ihre Kronen, klein und unansehnlich, sind nieht so scharf und kantig begrenzt, wie die der beiden andern Gruppen.

Wenn wir auch mit Rutimeyer übereinstimmen, dass sehr oft die Zähne Merkmale phyletischer Vorläufer an sich tragen, dass sie sich weniger rasch verändern als ihre Umgebung, so können wir im Allgemeinen doch die Ansicht vertreten, dass sieh die primären Zahnformen vorsugsweise bei den Bissarten finden, die solche Formen formal und functionell auszunutzen im Stande sind.

Diese aber sind idenstisch mit jenen, die ein Uebereinandergreifen der Zahnreihen möglichst ausschliessen.

Schon Carabelli macht darauf aufmerksam, dass die Zähne des physiologisch prognathen und des geraden Bisses zur Mastication viel nützlicher seien, als jene des regelmässigen Gebisses, was von vielen, auch von Sternfeld bestritten wird, was aber meiner Ansicht nach fraglos der Fall ist, besonders dann, wenn es sich um das Zerkleinern und Zermalmen harter oder zäher Nahrungsmittel handelt. In solchen Fällen werden die Excursionen des Unterkiefers auf ein Maximum gesteigert, wie es bei übergreifenden Frontzähnen einfach nicht möglich wäre.

Die dem zweiten Typus entsprechenden Zahnformen sind vorzugsweise den Bissarten eigentümlich, die durch ein mehr oder weniger starkes Uebereinandergreifen der Zahnreihen gekennzeichnet sind.

Auch schon beim sogenannten normalen Biss ist die rechteckige Form der Frontzähne häufig, mehr noch tritt sie in die Erscheinung bei pathologisch prognathen Bildungen und fehlt nur ungern bei der "dernière noveauté" im gegenseitigen Verhältnis der Kiefer zu einander, bei der relativen Prognathie, besser Opisthogenie.

Die zum dritten Typus zählenden, als pathologisch angesehenen Zahnformen entbehren selten eine abnorme Matrix; sie finden sich ganz besonders bei jenen Bissanomalien, die ihre Entstehung einer rhaehitischen Erkrankung verdanken, beim offenen Biss und bei der Prognathia rachitica, die ich später noeh eingehend besehreiben werde.

Neben der Form und dem Artieulationsverhältnis der Zahnkronen verdienen ferner die Waehstumsverhältnisse der Wurzeln von uns berücksichtigt zu werden. Wie ieh bereits im ersten Teile meiner Arbeit angedeutet habe, ist es weniger ihre relative Grösse und Stärke, die uns als Hilfsmittel bei der Differenzierung prognather Formen dienen könnte, als vielmehr der Verlauf der Wurzeln und ihr Lagerungsverhältnis zur Krone.

Das gilt hauptsächlich von den Frontzähnen.

Ihre Wurzeln liegen entweder direct in der Richtungsebene der Kronen oder sie bilden mit diesen einen mehr oder minder

stumpfen Winkel, indem sie entweder gradlinig verlaufen oder schwach gekrümmt.

Ist die Concavität dieser Krümmung labialwärts gerichtet, so liegen fast regelmässig pathologische Wachstumsverhältnisse vor, während palatinalwärts gekrümmte Wurzeln ebenso gut bei physiologisch prognathen Bildungen möglich sind. Der gradlinige Verlauf der Wurzeln ist bei der physiologischen Prognathie nur dann möglich wenn die Krone zur Wurzel im Winkel abgesetzt ist.

Die eben beschriebene pathologische maxillare Prognathie weist einen orthognath gerichteten Alveolarfortsatz und orthognath gerichtete Zähne auf und wie nicht anders zu erwarten ist, gradlinig in der Richtungsebene der Kronen verlaufende Wurzeln.

Dadurch unterscheidet sie sich ferner wesentlich von der physiologischen Prognathie, bei der die Frontzahnwurzeln, um bei dem sehr schräg und prognath gelagerten Alveolarfortsatz eine annähernd orthognathe Stellung der Zahnkronen, wie sie thatsächlich vorhanden ist, zu ermöglichen, nicht nur mit der Richtungsebene der Krone einen abnorm grossen spitzen Winkel bilden, sondern, ausserdem noch eine Krümmung aufweisen, deren Concavität palatinalwärts gerichtet ist.

Die durch einen relativ grossen Winkelabstand des Nasofrontalpunktes vom Subnasalpunkt charakterisirte Mittelgesichtsprognathie ist dann als rein maxillare anzusehen, wenn der Oberkiefer in seiner Gesamtheit von vornherein durch hereditäre Einflüsse vorgelagert, eine normale Ausbildung des Alveolarfortsatzes, des Gaumens und der Zahnreihen aufweist, so dass auch das Längen- und Breitenverhältnis des Kiefers nicht gestört ist.

Es ist wohl zu bedenken das eine Mittelgesichtsprognathie auch aus einer Deformation des übrigens normal gelagerten Oberkiefers resultiren kann, dadurch nämlich, dass der Längendurchmesser auf Kosten des Querdurchmessers wächst was häufig genug eine geringe Verschiebung des Subnasalpunktes nach vorn zur Folge hat.

Neben einer wenn auch geringen Mittelgesichtsprognathie findet sich dann gewöhnlich eine stark ausgeprägte Schräglagerung des Alveolartheils, der meisten Zähne mit schwach palatinalwärts gekrümmten Wurzeln und orthognath gerichteten Kronen trägt.

Eine geringe Mittelgesichtsprognathie wird durch den stark hervortretenden und schräggelagerten Alveolartheil ganz erheblich gesteigert. Das Verhältnis der Kieferlänge zur Kieferbreite ist hier gestört dadurch dass der Oberkiefer in der Richtung von vorn nach hinten auf Kosten des Querdurchmessers verlängert ist.

Im Zusammenhang damit beobachten wir eine gleichmässig steile Wölbung des Gaumens und seitlich abgeflachte Zahnbögen. Die hinsichtlich ihrer Kronen annähernd orthognath gerichteten Frontzähne werden nur mühsam von der Lippe bedeckt, zumal da sie mehr als normal über die ebenfalls orthognath gerichteten unteren greifen.

Ihre Wurzeln sind nicht nur nach innen gekrümmt, sondern auch zu den Kronen im verhältnismässig grossen spitzen Winkel abgesetzt.

Diese Formation beobachtet man häufiger und fast regelmässig im Zusammenhang mit der Mundathmung, für deren Entstehung und Ausbildung die sich ebenso oft im Nasenrachenraum findenden adenoiden Wucherungen verantwortlich gemacht sind.

Es liegt sehr nahe als wichtigstes ätiologisches Moment für die seitliche Compression des Oberkiefers den daraus sich entwickelnden hohen Gaumen und die sich darau anschliesscude alveolare und Mittelgesichtsprognathie die Mundatmung anzunehmen, jedoch sprechen neuere Untersuchungen dafür, dass Mundatmung und Gaumendifformität nicht Ursache und Wirkung, sondern beide im Grunde genommen nur die Folgeerscheinungen einer Wachstumsanomalie der Schädelbasis ist.

Hier möchte ich die interessante Arbeit Fritz Danziger's: "Die Missbildungen des Gaumens und ihr Zusammenhang mit Nase, Augem und Ohr" nicht übergehen.

Danziger weist nach, dass die Verbildungen und Missgestaltungen der einzelnen Knochen in bestimmter Weise mit bestimmten Synostosen einhergehen und dass besonders bei der Gaumenverbildung die Kranznaht eine wichtige Rolle spielt.

Gleichzeitig, so behauptet er findet sich eine Verbildung am basilare, "die von der grössten Wichtigkeit für die Missgestaltung der Schädelknochen ist, weil durch eine prämatäre Verwachsnng der Naht zwischen Keilbein und Hinterhauptbein das Wachstum des Keilbeins gehindert wird, das durch eine Verbindung mit allen Knochen und durch seine centrale Lage von grossem Einfluss auf die Entwicklung der Basis und die Missgestaltung einzelner Knochen ist, die wiederum auf den Gesichtsteil und besonders auf den Kiefer rückwirkt."

Eine Wachstumshemmung des Keilbeins soll vor allen Dingen die Entfernung zwischen dem vorderen Rande des Hinterhauptloches und der Nasenwurzel kürzer werden lassen.

"Da nun," so führt D. weiter aus, "zwischen dem Hinterhauptloch und der Nasenwurzel der Nasenrachenraum liegt, so wird natürlich durch die Verkürzung auch dieser Raum an Grösse einbüssen, sodass die Durchgängigkeit für die Luft schon durch geringe pathologische Bildungen verlegt sein kann und die Athmung durch den Mund erfolgen muss."

Diese Verkürzung hat jedoch noch weitere Folgen:

"Der Raum zwischen dem vorderen Rande des Hinterhauptloches und der Nasenwurzel ist von Knochen begrenzt, die am frühesten verknöchern; in Folge dessen werden die zwischen ihnen lagernden weichen und schwächeren Knochen sich zu einer normalen Entwicklung keinen Raum schaffen können, sie werden zusammengepresst und deformirt, jedoch nur dann, wenn sie von vornhereinnormal gross angelegt sind."

"Natürlich kann der Druck," so schliesst Danziger ab, "nur auf diejenigen Teile einwirken, welche in der Ebene der Schädelbasis liegen, das ist das Gaumendach in der oberen Parthie, welches Seitlich von vorn und hinten gepresst wird, sodass es schmäler und in der obersten Parthie kürzer wird; für die Hemmung oben tritt jetzt als Compensation ein vermehrtes Wachstum nach unten ein-der Gaumen wird tief und lang."

Wenn auch die Ausführungen Danziger's vollberechtigt sein sollten, so lässt sich doch auch andrerseits kaum bestreiten, dass eine schon frühzeitig zur vollen Ausbildung gelangte Mundatmung die Kieferform wie angenommen, zu beeinflussen vermag.

Durch die mit dem Herabsinken des Unterkiefers erfolgende Zerrung der Weichteile wird ein zwar schwacher, aber unausgesetzter Druck auf die Seitenteile des Oberkiefers in der Richtung von aussen nach innen und unten ausgeübt.

Die Wirkung dieses Druckes muss ein Näherrücken der beiderseitigen Alveolarfortsätze gegen die Mittellinie, ein Ausweichen des Gaumens nach oben und ein Vortreten des Zwischenkieferteils nach vorn sein.

Die Lippe aber wird die schräg durchbrechenden Kronen der Frontzähne nach innen und unten drängen. So erklärt sich leicht die Richtungverschiedenheit der Kronen und Wurzeln und die mehr oder minder starke Krümmung der letzteren.

Da, wie wir gesehen haben, bei der Beurteilung pathologisch prognather Formen auf das Verhältnis der Kieferlänge zur Kieferbreite grosses Gewicht zu legen ist, scheint es mir erforderlich, die Fragen zu erörtern: Wie sollen diese Grössen gemessen werden und wie verhält sich unter normalen Wachstumsverhältnissen der Querdurchmesser zum Längsdurchmesser?

Ich glaube, wir folgen hier mit Recht und Vorteil dem Fachmann, der eine ungeheure Zahl von Messungen der Kiefer der verschiedensten Stämme und Völker ausgeführt hat, um die degenerativen Veränderungen der Kiefer zu studiren und zu beweisen, Talbot nämlich.

Die Entfernung zwischen den Spitzen der mesialen Wangenhügel der beiden ersten Mahlzähne ist als Querdurchmesser anzunehmen, während der Längsdurchmesser so gemessen wird, wie schon angegeben.

Mühlreiter giebt zu, dass der Querdurchmesser des Oberkiefers im Sinne eben beschriebener Messung zwischen 51 und 55 mm. schwankt, während der Längsdurchmesser im Durchschnitt 57 bis 62 mm. aufweist.

Den Unterkiefer scheint Talbot weniger berücksichtigt zu haben; Mühlreiter lässt die Achse, die die hinteren Berührungsflächen der Weisheitszähne mit einander verbindet, als Querdurchmesser gelten. Ich meine aber, rücksichtlich der Vergleichung der Grössenverhältnisse des Unterkiefers mit denen des Oberkiefers würde es sich emphelen, auch hier die Verbindungslinie der mesialen buccalen Höcker der ersten Molaren als Querdurchmesser anzunehmen. Nach Messung einer grossen Anzahl normaler orthognather Gebisse an Lebenden sowohl als an Schädeln kann ich sagen, dass der Querdurchmesser des Oberkiefers durchschnittlich 4-6 mm. breiter als der des Unterkiefers ist, dass der Längsdurchmesser in beiden Kiefern gewöhnlich 5-6 mm. kürzer als der entsprechende Querdurchmesser ist. Gleichzeitig ist die Gaumenhöhe möglichst zu bestimmen und ich muss auch hier das Talbot'sche Verfahren* das ich selbst oft und gern angewandt habe, loben.

Während die maxillare Prognathie, bei der die einzelnen Kieferteile vollkommen normal entwickelt sein können, fraglos aus einer natürlichen intrauterinen Anlage hervorgeht, sind die Entstehungsursachen des alveolaren Prognathismus, der mit einem fehlerhaften Wachstum der Kiefer im Zusammenhang steht, im allgemeinen mehr secundärer Natur.

In erster Linie spielen hier jene Krankheiten eine grosse Rolle, die auf das Knochensystem einen ungünstigen Einfluss auszuüben vermögen.

Es sind insbesondere vererbbare und vererbte Allgemeinerkrankungen wie Rhachitis, Scrophulose, hereditäre Lues, die hemmend in die Entwicklung der Kiefer eingreifen.

Zwar soll vor allem das Längenwach-

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* Vergl. Talbot. Die Entartung der Kiefer des Menschengeschlechtes übersetzt von Bauchwitz. Leipzig. 1898.

stum der Kiefer von der eventuellen Einwirkung dieser constitutionellen Krankheiten ungünstig beeinflusst werden, ebensogut aber kann die Hemmung im Wachstum ausbleiben und eine directe Deformation der in Frage kommenden Knochen an ihre Stelle treten; ich halte es auch nicht für ausgeschlossen, dass Erkrankungen wie Rhachitis und Scrophulose durch ungünstige Beeinflussung der Wachstumsverhältnisse der Schädelbasis den ersten Grund legen zu unnormaler Ausbildung der Kiefer.

Bei schwächlichen, scrophulosen und rhachitschen Kindern findet sich relativ häufig ein schmaler Kiefer und ein hohes Gaumengewölbe. Diese hohen Kiefer sind aber fast immer sehr lang, sodass von einer Hemmung des Längenwachstums kaum die Rede sein kann.

Das trifft auch vielfach zu für den sogenannten V förmigen und den contrahirten Kiefer, die meiner Ansicht nach in ihrer ersten Anlage vererbt oder durch constitutionelle Erkrankungen bedingt sind.

Man nimmt vielfach an, dass gerade diese Formen auf eine später beim Wachstum der Kiefer erworbene Irregularität zurückzuführen sind, da sie sich im Milchzahngebiss nicht finden.

Das sagt meiner Ansicht nach aber nicht allzuviel, denn das Typische der Vererbung in der Gestaltung der Kiefer kommt erst mit der Ausbildung des bleibenden Gebisses zum Vorschein und zur Geltung.

Das Bild der pathologischen "alveolaren" Prognathie ist vielseitig und mannigfaltig, bald ist durch die Verbildung der Kiefer der Subnasalpunkt so weit vorgeschoben, dass neben der alveolaren auch eine geringe Mittelgesichtsprognathie besteht, bald wieder scheint er in seiner Lage unbeeinflusst geblieben zu sein; Stellung- und Achsenverlauf der Zähne variiren ebenfalls stark.

Immerhin aber giebt es eine Reihe von Formen, die durch ihre Eigenarten so viel Typisches gewinnen, dass sie leicht wiederzuerkennen und leicht von einander zu unterscheiden sind.

Eine sofort wahrnehmbare alveolare Prognathie ist mit einem geringen Grade von Mittelgesichtsprognathie gepaart, sodass der Zwischenkiefer vorgestellt und etwas nach unten gezogen zu sein scheint. Der Oberkiefer hat durch eine starke seitliche Compression an Höhe zugenommen, die besonders in der Länge der Oberlippenpartie zum Ausdruck kommt.

Häufig genug findet sich daneben eine wulstige und dicke Lippe, die im Zusammenhang mit einer Schwellung der Unterkieferdrüsen den torpid scrophulosen Gesichtsausdruck zum Vorschein bringt.

Der Längsdurchmesser des Oberkiefers ist Verhältnismässig grösser als der Breitendurchmesser.

Dagegen weist der Unterkiefer entweder normale Verhältnisse auf oder ist abnorm kurz, sodass die Articulation vielfach um die Breite eines Backenzahnes verschoben ist. So kann sich also der Prognathie die Opisthogenie zugesellen.

Regelmässig aber ist das der Fall bei den durch Rachitis bedingten Kieferdeformitäten.

Die rachitische Prognathie ist eine Form für sich, die ohne Zweifel durch Aufweisung bestimmter Eigentümlichkeiten stets leicht als solche zu erkennen ist.

Schon Carabelli behauptet, dass vorstehende Gebisse häufig bei Rachitischen gefunden werden, um so mehr überrascht die Bemerkung Sternfeld's dass ihm nichts davon bekannt sei, dass bei Rachitischen besonders häufig Prognathie vorkomme.

Dr. Heinrich Schmid hat jedoch in seine Arbeit "Die rachitische Kieferformation" nachgewiesen, dass die hauptsächlichste Veränderung der Kieferknochen, wenn sie rachitisch erkrankt sind, darin besteht, dass der Unterkiefer gegenüber dem normalen verkürzt, dass dagegen am Oberkiefer der rachitische Process gerade umgekehrt zu einer Verlängerung seiner medialen Achse und in den ausgeprägtesten Fällen zu einer Einsattelung führt.

Ich habe selbst ein reichliches rachitisches Material, das mir durch den Vorsteher der hiesigen Universitäts-Kinder-Klinik gütigst zur Verfügung gestellt wurde, diesbezüglichen Untersuchungen unterworfen und kann die Ausführungen Schmid's bestätigen.

Er beschreibt kurz und treffend die rachitische Deformation der Kiefer Erwachsener wie folgt:

"Vor allem fällt auf, dass der in Folge von Rachitis deformirte Unterkiefer seine normale parabolische Gestalt verloren und eine polygonale angenommen hat, die ungefähr der Hälfte eines nicht ganz regelmässigen Hexagons entspricht.

"Diese Formveränderung kommt durch die Abflachung der Krümmung des Kiefermittelstükkes zu stande.

"Hand in Hand damit geht die Verkleinerung der medialen Achse und der transversalen Entfernungen aller correspondirenden Punkte der Unterkieferseitenteile.

"Letzteres ist die Folge der bedeutenden Einwärtsneigung der die Backen- und Mahlzähne tragenden Alveolarfortsätze.

"Diese führt zu einer messbaren Annäherung der Seitenäste des Unterkiefers."

Die rachitische Veränderung des Oberkiefers beim Erwachsenen besteht nach Schmid in einer wesentlichen Verlängerung seiner langen Achse und in einer Einsattelung zwischen dem zweiten Backenzahn und dem zweiten Mahlzahn.

Ich gebe gern zu, dass der sattelförmige Kiefer das Resultat der Rachitis sein kann; ich bemerke jedoch dazu, dass er nachgewiesenermassen ein häufiges somatisches Merkmal des Idiotismus darstellt und dass er soweit ich beobachtet habe, sehr oft vererbt wird.

Es ist ja allerdings nicht ausgeschlossen, dass eine ursprüngliche rachitische Bildung sich durch mehrere Generationen auch in Form eines sattelförmigen Kiefers vererbt.

Aus der annähernd entgegengesetzten Verbildung der Kiefer bildet sich der sofort auffällige "rachitische Kieferschluss" (Fleischmann), der sich durch einen Zwischenraum zwischen den Frontzähnen und eine unnormale Articulation der Seitenzähne documentirt.

Die Verlängerung des Oberkiefers, die Verkürzung des Unterkiefers und der stets daraus resultirende mangelhafte Zahnreihenschluss sind jeder rachitischen Kieferverbildung eigentümlich, trotzdem aber ist diese Formation nicht immer gleichartig gestaltet, sie variirt, möchte ich sagen, entsprechend der Ausdehnung, der Schwere der Erkrankung und dem Wechsel der Kräfte, die von aussen auf den mehr oder minder erkrankten Knochen einwirken.

Der rachitische Process als solcher wird nur insofern die normale Form des Knochens verändern, als er zu einer abnormen Knorpelwucherung Veranlassung giebt.

"Von einer durch abnorme Knorpelwucherung bedingten Deformation der Kieferknochen," sagt Schmid, "kann nur insofern die Rede sein, als im Oberkiefer die Verbindung des Os incisivum mit dem Oberkiefer in der foetalen Periode

und der ersten Zeit der Kindheit durch eine dem Faserknorpel ähnliche Masse hergestellt wird und durch eine Wucherung dieser knorpelartigen Substanz eine Verdickung des Oberkiefers am hinteren Rande des Os incisivum möglich gemacht wird."

Aus den Untersuchungen David von Hansemanns über die Rachitis des Affenschädels geht hervor, dass eine bindegewebige Wucherung, verbunden mit einer verzögerten Ossification an der Nahtverbindung des Zwischenkiefers mit den Seitenteilen des Oberkiefers infolge einer rachitischen Erkrankung an Affenschädeln häufiger zu beobachten ist. Er bringt in der Abbildung 9 seiner Arbeit einen stark rachitischen Schädel zur Anschauung, an dem die Zwischenkiefer in dicke wulstige Gebilde verwandelt sind.

Denselben Zustand hat von Hansemann auch beim Menschen beobachtet und auch ich kann sagen, dass mir diese Bildung am menschlichen Kiefer nicht fremd ist.

Auf die Gestaltung des Unterkiefers wirkt die Rachitis ebenfalls nicht direct deformirend ein; von einer durch abnorme Knorpelwucherung bedingten Verunstaltung kann hier überhaupt nicht die Rede sein.

Wohl hat der Krankheitsprocess eine gleichmässige Verdickung des Knochens zur Folge, nicht aber eine Verbildung seiner Form.

"Es wird wohl," sagt Schmid, "eine mehr minder gleichmässige Volumzunahme der Kiefer bewirkt, aber keineswegs jene Abweichungen von den normalen Krümmungsverhältnissen, welche wir oben am Unterkiefer sowohl als am Oberkiefer für die rachitische Deformation als charakterisch erkannt haben. Zur Erklärung dieser müssen wir die Ursachen nicht in dem Knochen selbst, sondern vielmehr ausserhalb desselben suchen."

Die rachitische Knochendeformität überhaupt führt Schmid auf 3 verschiedene ätiologische Momente zurück, auf die Körperbelastung, Muskelaction, mechanische Einwirkung.

Für die Deformation der Kiefer speciell des Unterkiefers, kommt hauptsächlich die Action der den Kiefer direct angreifenden Muskeln in Betracht.

Vielfach ist sogar die Deformation so sehr im Sinne der Muskelaction ausgeprägt, dass man leicht die schuldigen Muskeln errät.

Natürlich spielt die Ausdehnung und Schwere der Erkrankung selbst eine grosse Rolle und wird bald diesen, bald jenen Muskeln Gelegenheit geben, ihre Wirkungsweise zu verkörpern.

Fast regelmässig erkennen wir in der abnormen Gestaltung der Kiefer den Einfluss des Musculus mylohyoideus, den Genio glossus und des Masseters.

Der Mylohyoideus, von der Linea obliqua interna des Unterkiefers entsspringend und an der vorderen Fläche der Zungenbasis endigend, wirkt bei fixirtem Zungenbein in der Weise, dass er die beiden Seitenteile des Unterkiefers nähert und einwärts neigt.

Dem Genio hyoideus, der als paariger Muskel bei fixirtem Zungenbein auf das Mittelstück des Unterkiefers einen Zug ausübt, wird die Abflachung der Kinnpartie zum grössten Teil zugeschrieben.

Gleichzeitig mit diesen Muskeln wirkt der Masseter deformirend auf den Unterkiefer ein.

Wegen seiner Stärke und seiner überaus günstigen Angriffspunkte wird er leicht im stande sein, nicht nur eine Einwärtsstürzung der Seitenäste zu verursachen, sondern auch eine Abstumpfung des Unterkieferwinkels.

Für die Formveränderung des Oberkiefers kommt eine Muskelwirkung schwerlich in Frage; es ist vielmehr anzunehmen, dass entweder der bereits modificierte Unterkiefer die Form des Oberkiefers beeinflusst oder dass durch den rachitischen Process bedingt, Wachstumsstörungen im Bereiche des Schädelgrundes zu abnormer Gestaltung des Oberkiefers führen.

Ausser der Modificierung der Längsachsenverhältnisse beider Kiefer und dem daraus resultirenden Kieferschluss fällt die Abflachung der mittleren Partie des Unterkiefers und das Absinken der Seitenzähne sowohl im Unter- als im Oberkiefer ganz besonders ins Auge. Ebenso auffallend ist die feste Position des Subnasalpunktes, die eine Mittelgesichtsprognathie in den meisten Fällen ausschliesst.

Hieraus resultirt eine Schräglagerung der Lippen, zwischen denen gewöhnlich schräg gestellt Frontzähne hervortreten.

Gleichzeitig erscheint die Nasenöffnung etwas nach vorn gerichtet und die Flügel der Nase sind nach oben abgelenkt.

Dieses Verhaltnis aber wird gestört, wenn neben dem Masseter auch der Riventer seine Kraft an der Kieferform zum Ausdruck gebracht hat. Dann ist das Mittelstuck des Unterkiefers abwärts gezogen, während die Seitenteile durch den Masseter in ihrer Lage gehalten oder aufwärts gerichtet sind.

Ausser der relativen Länge der unteren Gesichtspartie resultirt daraus ein offener Biss, der die Function des Gebisses noch mehr beeinträchtigt als der einfache prognathe rachitische Kieferschluss.

Für das Zustandekommen einer absoluten pathologischen Prognathie ist nicht immer die hereditäre Anlage oder die Einwirkung constitutioneller Erkrankungen erforderlich; manchmal sind es auch Störungen und abnorme Wachstumsverhältnisse innerhalb des Kauapparates selbst oder auch mancherlei Lebensgewohnheiten, die durch mechanische Einwirkung ein Vortreten der Mundpartie bewirken. In solchen Fällen handelt es sich aber regelmässig um rein alveolare prognathe Bildungen, die weder eine Vorlagerung des Subnasalpunktes nach vorn, noch eine Vertiefung des Gaumengewölbes nach sich ziehen.

Die Richtungsebene der Zahnkronen entspricht fast immer der der Wurzeln, die entweder gerade oder labialwärts concav gekrümmt verlaufen.

In vielen Fällen liegt die Ursache der Prognathie in einer zu späten oder zu mangelhaften Entwicklung der Seitenzähne oder auch in der frühzeitigen Extraction derselben, insbesondere der ersten Molaren. Wenn diese vor dem Erscheinen der Praemolaren und der zweiten Molaren entfernt werden, so verliert der Unterkiefer seine Stütze nach hinten und die ganze Kraft desselben wirkt dann auf die Basis der Kronen der oberen Schneidezähne, wodurch sich notwendigerweise ein prognather Zustand herausbilden muss.

Die Prognathie, die auf diese Weise zu stande kommt, hat, soweit ich beobachtet habe, auch dann noch einen progressiven Charakter, wenn durch die später erscheinenden Praemolaren seitlich eine Stütze geschaffen worden ist.

Ebenfalls progressiv sind die prognathen Formen, die durch Daumenlutschen, Lippenpressen, oder ähnliche mechanische Einwirkungen zu stande gekommen sind.

In all diesen Fällen haben wir es mit einem dentalen Prognathismus zu thun,

der stets eine Schräglagerung des Alveolartheils einschliesst.

Schräg gelagerte Kronen mit gleichgerichteten Wurzeln können selbstverständlich neimals einen orthognath gestellten Alveolartheil als Matrix besitzen; wohl ist der umgekehrte Fall möglich, dass nämlich orthognath gerichtete Zahnkronen einem schräg gelagerten Alveolartheil angehören, wenn die Wurzeln stark nach innen (palatinalwärts) gekrümmt sind. Ich halte es deswegen auch für verfehlt, wenn man die dentale Prognathie von der alveolaren als eine besondere Form zu unterscheiden sucht.

Eine "absolut dentale Prognathie," bei der also nur die Zähne schräg gerichtet sind oder vorstehen, giebt es nicht, es sei denn, dass man den senilen Schiefstand der Frontzähne als solche gelten lasse.

Für die Form der Prognathie, die ihre Entstehung der frühzeitigen Entfernung der Seitenzähne verdankt, mache ich als besondere Merkmale geltend eine gerade oder nach aussen gekrümmte Zahnwurzel einen tiefliegenden Subnasalpunkt, der annähernd in der Richtungslinie der Zahnkrone gelagert ist und einen im vorderen Teil abgeflachten Gaumen.

Die unteren gewöhnlich orthognath gerichteten Frontzähne berühren unter einem mässig stumpfen Winkel die lingualen Höcker der sehr schräg gelagerten oberen Zähne. Die Seitenarticulation kann eine normale sein.

Die Abschnitte des Profils sind nicht mehr ganz gleichmässig proportionirt, da die Mundpartie verkürzt ist. Eine wesentliche Verschiebung der Achsenverhältnisse beider Kiefer ist ausgeschlossen.

Anders jedoch bei den durch Daumenlutschen, Lippenpressen und andre üble Angewohnheiten erzeugten prognathen Bildungen.

Hier giebt es stärkere Verschiebungen sowohl bezüglich der articulation wie auch der Achsenverhältnisse, so zwar, dass der Kieferkörper selbst, besonders auch der Basalteil der Kinnpartie des Unterkiefers, von der Deformation nicht merklich beeinflusst werden.

Das Lippenpressen, das Saugen auf einem oder mehreren Mittelfingern, bewirkt eine Ausbuchtung des Alveolarfortsatzes im Bereiche der oberen Frontzähne, ohne die Stellung der unteren Zähne wesentlich zu beeinflussen.

Besonders wirksam sind die von den Müttern sorgsam gepflegten, von den Kindern ängstlich gehüteten Lutschbeutel, die thatsächlich schon während des Bestandes des Milchzahngebisses eine nicht unbedeutende absolute Prognathie herbeiführen können.

Das Lutschen wird auch noch während des Zahnwechsels und nach vollendeter Einstellung der bleibenden Frontzähne vielfach eifrig betrieben und zeitigt dann den verschiedenen Lutschobjecten entsprechend recht auffallende, leicht ätiologisch zu begründende Deformationen des bleibenden Gebisses.

Aber auch selbst dann, wenn die mehr oder minder intensive Ausübung dieser Unart vor oder mit dem Untergang des Milchzahngebisses eingestellt wird, kommt es zu einer Schräglagerung der oberen Frontzähne und ihrer Matrix.

Denn je häufiger ein horizontaler Druck oder Zug auf die Milchzähne einwirkt, um so starker werden sich die Druckbahnen über ihnen ausbilden und um so schräger werden die Trajectorien der Spongiosa verlaufen.

Dieser Beanspruchung des Knochens werden aber die in der Entwicklung und im Durchbruch begriffenen Zähne nach Möglichkeit folgen.

Ich halte es aus diesem Grunde nicht allein für berächtigt, sondern auch für erforderlich, die absolute Milchzahnprognathie orthopädisch zu behandeln.

Das ist erstens leicht möglich und zweitens für die Einstellung der bleibenden Zähne durchaus vorteilhaft, wie ich aus eigener Erfahrung weiss.

Während das Lutschen auf einem Finger (Mittel- oder Zeigefinger) fast immer nur eine partielle Prognathie erzeugt, garantirt die Anwendung mehrerer Finger oder auch des Schnullers als Lutschobject ein gleichmässiges Hervortreten des Oberkiefermittelstückes; eine halbseitige Prognathie liefert das Tuch- und Bettzipfelziehen, weil hierin nur die Zähne einer Kieferhälfte benutzt werden.

Wie schon Walkhoff bemerkt hat, ruft das Saugen auf den Daumen eine etwas andere Wirkung hervor, als das Saugen auf den Mittelfingern, denn mit der Nagelseite der unteren Zahnreihe zugewandt, wirkt der Daumen als schiefe Ebene auf beide Kiefer, und da die oberen Zähne beim Zusammentreffen der Kiefer von vornherein einem grösseren Drucke ausgesetzt sind, als die mittleren, so werden sie hauptsächlich aus ihrer Stellung gebracht.

Dadurch, dass die oberen Zähne weiter nach vorn, die unteren aber nach rückwärts gedrängt werden, entsteht eine dem rachitischen Kieferschluss ähnliche Bildung.

Einer Wölbung des vorderen Teiles des Oberkiefers entspricht eine manchmal recht bedeutende Abflachung der oberen Parthie des Unterkiefers der dann von oben betrachtet, der Form eines Trapezes ähnelt.

Diese Wölbung resp. Abflachung bleibt aber auf den Alveolartheil beschränkt, sodass im Oberkiefer eine Lageveränderung des Subnasalpunktes ebensogut ausgeschlossen ist als im Unterkiefer eine Abflachung des Kinnes, das vielmehr rund und vielfach sogar spitz erscheinen kann.

Die Lutscherprognathie, so lange sie für sich besteht und aus normalen orthognathen Verhältnissen hervorgegangen ist, modificirt nur die Gestaltung der Subnasalparthie. Die Höhe der Mundkinnregion wird durch sie wenig oder garnicht beeinflusst. Trotzdem setzt sie die Schönheit des Antlitzes nicht unbedeutend herab, was jedoch durch orthopädische Maassnahmen leicht wieder auszugleichen ist.

Die Seitenarticulation kann ebensogut normal als anormal sein.

Besteht dagegen neben der Lutscherprognathie noch eine mehr oder minder starke opisthogenie, so ist das Articulationsverhalten auch der Seitenzähne regelmässig gestört derart, dass die obersten Molaren zum mindesten um die Hälfte ihrer Breite vor der Unteren liegen.

Ferner bedingt diese Combination einen recht unangenehmen, hässlichen Gesichtsausdruck.

Der Aufbau des Profils und das dimensionelle Verhältnis der einzelnen Gesichtsabschnitte zu einander sind für die Diognostik pathologisch prognather Bildungen ebenso wichtig, wie das Lagerungsverhältnis der Kiefer und Zahnbögen zu einander.

Erst die Berücksichtigung beider Punkte garantirt eine richtige Beurteilung der hier in Rede stehenden abnormen Wachstumsverhältnisse.

Manche scheinbar prognathen Profile erweisen sich bei der Messung als ausgesprochen orthognath.

Der Prognathismus ist hier nur vor-

getaüscht dadurch, dass der Unterkiefer im Wachstum zurückgeblieben oder abnorm gelagert ist, während sich der Oberkiefer normal entwickelt hat. Man darf hier also von einem Prognathismus eigentlich gar nicht sprechen, wenn ich trotzdem diese Bildungen als relative Prognathismen bezeichne, so wollte ich sie damit nur der wirklichen, der absoluten Prognathie zur Unterscheidung gegenüberstellen; sachlicher wäre entschieden die Bezeichnung "Opisthogenie."

Für das Zurücktreten des Unterkiefers können verschiedene ätiologische Momente geltend gemacht werden, vor allem zunächst eine abnorme Kleinheit des Unterkiefers (Mikrognathie), die entweder den Knochen in vollem Umfange betrifft oder nur im Körper oder in den Aesten besteht.

Sodann aber ist die Standabweichung des Unterkiefers nach Vrolik und Betz* fraglos abhängig von abnormen Wachstumsverhältnissen der Schädelbasis. Vrolik macht insbesondere darauf aufmerksam, dass das Vor- oder Rückwärtsrücken der Schläfenbeine und somit der Gelenkpfannen des Unterkiefers für dessen Stellung von grösstem Einfluss sein muss.

Vrolik's Beobachtungen betreffen in der Hauptsache die Kiefer eines todtgeborenen, aber reifen Kindes und die eines Erwachsenen. Der Unterkiefer des Kindes, das überdies viele andere Anomalien im Entwicklungsgange zeigte, erstreckte sich kaum so weit nach vorn, dass er die Hälfte des knöchernen Gaumens erreichte.

"Der rechte Unterkieferast war um ein Viertel länger als der linke, wodurch er eine schiefe Gestalt bekam. Die Gelenkköpfe waren breiter als rund und standen in gleicher Höhe mit dem oberen Rande des Zahnfortsatzes.

"Ausser diesen Anomalien fanden sich am Schädel noch folgende bemerkenswerte:

"Die grossen Flügel des Keilbeines waren ausserordentlich in die Breite gedehnt, drängten dadurch die Schuppen des Schläfenbeins nach hinten, ebenso die Felsenbeine, die statt einer nach vorn convergirenden, eine quere Lage hatten."

Dass der Oberkiefer kurz und schmal war, betont Vrolik ausdrücklich Er meint nun, dass die überaus breite Entwicklung der grossen Keilbeinflügel die Schläfenbeine, die Träger der Gelenkpfannen für den Unterkiefer, nach hinten gedrängt haben und dass auf diese Weise der Weg für den Unterkiefer zu weit geworden sei als dass er den Zahnbogen des Oberkiefers hätte erreichen können.

In diesem Falle haben wir es also nicht mit einer absoluten, sondern mit einer relativen Kleinheit des Unterkiefers zu thun.

Der zweite von Vrolik beschriebene Fal hat mit dem ersten das gemein, dass auch hier der Unterkiefer auffallend weit zurücktritt, allerdings wie Betz nachzuweisen versucht hat, aus ganz andern Gründen.

Vrolik beschreibt diesen Fall wie folgt:

"Der Umfang des Zahnbogens des Unterkiefers war sehr klein, doch mit dem des Oberkiefers übereinstimmend. Die Vorderzähne des Unterkiefers reichten nur bis zu der Stelle des Oberkiefers, wo die Eckzähne stehen. Der hintere Mahlzahn stand ganz frei von seinem Gegenfüssler. Jede Kieferhälfte hatte nur 4 Mahlzähne, also 16 im Ganzen. Die Schneidezähne waren stark vorwärts gestreckt, wodurch der Schädel, zumal

* Vergl. Betz Friedrich: Physiologisch-pathologische Untersuchungen über Deformitäten des menschlichen Kiefers. Zeitschr. für rationelle Medicin.

vorn bei dem flachen und zurückgedrängten Vorderhaupt, eine tierische Form erhielt. Der Winkel des Unterkiefers war zugespitzt, mit dem senkrecht aufsteigenden Unterkieferast zu einer geraden Linie verbunden, ferner war er auswärts gebogen und hatte vor sich einen halbmondförmigen Ausschnitt. Die Kronenfortsätze standen spitzig vorwärts und waren nach innen umgebogen. Die Incisura semilunaris fehlte. Von den Gelenkfortsätzen fand man nur eine kleine ängliche Erhabenheit, nicht auf einem Halse aufsitzend."

Da sich auch an diesem Schädel eine starkere Breite der grossen Flügel des Keilbeins fand, die allerdings nicht so beträchtlich war als an dem Kopfe des Kindes, so war Vrolik auch hier geneigt, das Zurücktreten des Unterkiefers von der Breite des Grossen Keilbeinflügels abhängig zu machen.

Betz jedoch, der diesen Schädel gleichfalls eingehend untersuchte, erklärt, dass die Opisthogenie in diesem Falle lediglich aus einer angeborenen Kleinheit des Unterkiefers resultire, wie auch aus der Abbildung leicht ersichtlich ist.

Die von Vrolik untersuchten und beschriebenen Fälle sind zweifelsohne stark pathologischer Natur und gehören gewiss zu den Seltenheiten.

Wir beobachten durchweg geringere Grade von Opisthogenie, die meine Ansicht nach mit Wachstumsstörungen am Schädelgrunde wenig oder gar nichts zu thun haben.

Es handelt sich hier fraglos in den meisten Fällen um eine Hemmung des Längenwachstums des Unterkiefers, die einerseits im Anschluss an Allgemeinerkrankungen eintreten, andererseits aber auch als Folge bedeutend herabgesetzter Function des Unterkiefers angesehen werden kann.

Es ist nicht zu bestreiten, dass das Längenwachstum der Kiefer, speciell des Unterkiefers, mit der Function des Kauapparates im engsten Zusammenhang steht. Das allmähliche Verschwinden des dritten Molaren im Gebiss des Culturmenschen ist schon ein Beweis dafür.

Auch die directe Messung kann beweisend eintreten.

Die Angabe Bonwills, dass der Abstand der beiden Gelenkköpfe des Unterkiefers der Entfernung der Gelenkköpfe bis zu dem Berührungspunkte der mittleren Schneidezähne entspricht, gilt nur für die civilisirten Völker.

Bronko wies an prognathen Kiefern von Negern nach, dass der Abstand der Gelenkköpfe von den Schneidezähnen um 2 bis 3 cm. grösser sei, als die Entfernung der Gelenkköpfe von einander.

Dass der Unterkiefer mehr als der Oberkiefer unter der Wachstumshemmung in Folge herabgesetzter Function zu leiden hat, liegt auf der Hand.

Er bildet den unmittelbaren Angriffspunkt der in ihrer Wirkung modificirten Kräfte und ist der formgestaltenden Thätigkeit der Muskeln um so mehr ausgesetzt, als er nicht eingeengt wird durch feste Verbindung mit anderen Knochen.

Der Oberkiefer dagegen wird nicht direct beansprucht durch die Function der Kaumuskeln und erhält, wenn ich so sagen darf, seine functionellen Reize erst durch die Bewegungen des Unterkiefers. Dazu kommt, dass die feste Verbindung mit den Knochen des Hirnschädels eine functionelle Gestaltung dieses Knochens einschränkt.

Die Opisthogenie, wie wir sie gewöhnlich beobachten, ist, wenn sie nicht durch Allgemeinerkrankungen, die das Wachstum des Knochens ungünstig beeinflussen, bedingt wird, als das Resultat physi-

ologisch functioneller Selbstgestaltung anzusehen.

In diesem Sinne betrachte ich die Opisthogenie als einen Excess typisch-menschlicher Fortbildung, als die "Derniere Nouveauté" im Kieferbau des Culturmenschen, die sich mit der Zeit erblich fixiren wird.

Aus der mangelhaften Ausbildung des Unterkiefers resultirt regelmässig ein abnormes Lagerungsverhältnis der beiden Zahnreihen zu einander.

Sehr häufig sind die unteren Zähne um die Hälfte der Breite der ersten Molaren gegen die oberen nach hinten verschoben, was nicht nur ein Hervortreten der unteren Frontzähne, sondern auch eine prognathe Stellung der oberen und ihrer Matrix bedingen kann.

Die Opisthogenie ist stets eine primäre Erscheinung, die aber ihrerseits Veranlassung geben kann zu secundärer Prognathie des Oberkiefers.

Besonders bemerkenswert ist noch, dass der Oberkiefer durch die in Rede stehende mangelhafte Entwicklung des Unterkiefers nich derart beeinflusst wird, dass er eine für die Opisthogenie typische Form gewinnt.

Vielmehr finden sich alle möglichen Combinationen; besonders häufig aber beobachtet man-das hat Bride bereits angegeben, der sich um die orthopädische Behandlung dieser Anomalie verdient gemacht hat, zwei Formationen.

Die eine ist characterisirt durch eine mehr oder weniger grosse Enge des Oberkieferbogens, Länge, Schräglagerung und Vorstehen ev. der oberen Frontzähne; die zweite ist gekennzeichnet durch besonders stark uberfällende, orthognathe, manchmal sogar invertirte Frontzähne bei mehr normaler Gestaltung des Gaumens.

Während die Nase und die Subnasalgegend wenig oder garnicht durch die Opisthogenie zu Ungunsten des Profils beeinflusst wird, setzt die zurücktretende Kinnpartie die Schönheit des Antlitzes ausserordentlich zurück.

Im voliegenden Abschnitte konnte ich bei weitem nicht alle Möglichkeiten prognather Bildung berücksichtigen; ich habe mich darauf beschränkt, principiell verschiedene Formen aufzustellen und sie nach ihren Eigentümlichkeiten zu differenziren, Formen, die meiner Ansicht nach typisch genug sind, abschliessende Gruppen zu bilden.

Erst nachdem man gelernt hat, die einzelnen prognathen Bildungen richtig zu beurteilen, wird man mit Erfolg an ihre orthopädische Behandlung gehen können, über die ich in einem vierten Abschnitte berichten werde.

Following is a brief *résumé* in English of the foregoing paper:

Studies on Prognathism.

The author defines prognathism from the standpoint of the anthropologist. Anthropological investigations have not been duly taken into consideration in dental literature, and likewise anthropologists have omitted consideration of the shape, function, and other characteristics of the teeth. Orthodontists should not lose sight of the fact that the development and function of the jaws influence the face in the naso-frontal region and all the other facial points which anthropologists use as guides in their measurements, which may become changed by alterations in the shape of the jaws.

A thorough study of the functions and structure of the bones of the face is one of the requisites of the orthodontist.

The bones of the face in their arrangement, structure, etc., should be studied by means of the X ray.

The author discusses extensively all the forms of prognathism, not omitting what he terms physiological prognathism, which he fully describes before entering upon the study of the several types caused by pathological developments often so difficult to diagnose.

He studies the anatomical relations of the bones of the face in prognathism and shows the artistic result of treatment when carried on in harmony with their cause. The study of all the forms of prognathism is a *sine qua non* for the successful orthodontist.

Discussion.

Dr. N. S. Hoff, Ann Arbor, Mich. This paper follows very closely the object we desire to reach in placing the practice of orthodontia on a scientific basis, which seems to be the keynote for most of the work that has been presented in the various sections of the congress which I have attended. The study of etiology is essential before we can arrive at any basic principle of practice. It may be well for us to remember when making a study of these problems that we should not undertake to study the pathological condition we find in extraordinary operations and attempt from those pathological specimens to derive fundamental principles, because they are unusual and happen so seldom that they are not of sufficient importance to be of any great value in establishing principles of development, even of pathological principles. We learn little of practical value from perverted development under abnormal conditions. I do not think it well to spend much effort to establish principles for treating pathological conditions which result in very great deformities of only occasional occurrence. We have to treat teeth that are brought into malocclusion because of diseases of the teeth and their environment, and I agree with the author that it is almost impossible or impracticable to undertake to establish results that have come from certain diseases of the bone, restore the teeth to occlusion and transform the bone into normal structure. You all know how difficult it is to attempt to bring into normal relation teeth that have been driven out of this relation in pyorrhea, for instance, or diseases of the gum, and how much more difficult it is when we get a more serious disease of the jaw. It is also a serious problem to undertake to treat those conditions which result from interruption in the embryonic or developmental period.

So I think that while these things are interesting, they do not serve as a basis upon which we can build very satisfactory principles for the practice of the art of orthodontia.

Dr. Schroeder closed the discussion, speaking in German.

The section then adjourned *sine die.*

END OF THE SECOND VOLUME.

FAUCHARD
HAYDEN
CARABELLI
HARRIS
LINDERER
TOMES
SAUER
TURNER
DUBOIS